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THE JOURNAL OF INDUSTRIAL HYGIENE

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THE HYGIENIC SIGNIFICANCE OF NICKEL*

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From the Department of Physiology, Harvard School of Public Health

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INTRODUCTION

THE studies constituting this monograph have as their aim the establishment of the position of nickel and nickel compounds as affecting living material from the lowest forms through man.

The first section of the work consists of a classified analysis, which is believed to be complete, of previous observations on the general subject. These data are arranged for reference use and can be utilized with convenience by means of the table of contents. The bibliography covering the section is presented numerically and corresponds approximately in arrangement with the subject headings found in the table of contents. No brief general summary of the literature has been attempted, the desire being to furnish an encyclopedic review to which reference upon particular questions may be made.

The particular point on which the authors have desired information has rested with the question of damage to man from using food or drink cooked or stored in nickel or nickel-lined containers. By referring to the observations recounted under III C (ii) and (iii),[1] the reader will find that a considerable volume of data—and more of opinion—already exists upon this question; but it may be said that the major part of the substantial experimental evidence is favorable to the use of nickel cooking utensils and containers. If, however, one reads this literature carefully, one is almost at once impressed by the lack of uniformity of the results and becomes convinced that this is in large part due to the failure of the analytic methods employed.

In order to make possible the experiment described in the third section of the monograph, it was necessary to have available a new and more accurate method for nickel analysis, and this has been devised by L. T. Fairhall and forms the second section of the monograph. The third and final section of the work treats of an experiment on a small group of human subjects placed under circumstances of nickel ingestion from foods cooked and at times kept in nickel containers to the practical exclusion of all other cooking ware. The experiment had as its purpose the accurate definition of maximum amounts of nickel ingested by subjects of varied age; settlement of the question as to whether nickel appeared in the urine, and, if so, in what amounts and how constantly; and, finally, whether under this intensive régime any evidence of harm to the subjects could be found. This section is preceded by a statement of the rationale of the experiment conceived by the authors and ends with conclusions which, it may be stated here, are favorable to the use of nickel cooking utensils.

[1] See pp. 335-339.

J. I. H.
Dec., 1924

Section 1

A Review of the Biologic and of the Physiologic Action and of the Toxicology of Nickel

I. Normal Occurrence of Nickel

Nickel occurs very generally in small amounts in soils, in plants, and in the tissues both of simple and of complicated organisms. As early as 1855, Forchammer (1) demonstrated the presence of nickel in the superficial layer of the earth, in marine algae, and in the oak. During the period from 1870 to 1890 the existence of nickel is reported in cosmic dust and in isolated cases in plants (2). Lehmann (3), in 1909 in the course of an hygienic study of nickel, determined the normal nickel content of spinach to be 0.66 mg. per kilo; of cow and of ox liver, 0.2 mg. per kilo; and of beef, 0.8 to 1.6 mg. per kilo. This same author reports Kassner as having found 100 mg. of nickel per kilo in grain. McHargue (4), research chemist of the Kentucky Experiment Station, is reported to have found appreciable amounts of nickel in virgin and cultivated soils from three different geologic formations in Kentucky. Cornec (5), in 1919, using the spectroscopic method of analysis, found nickel in seaweed (*Laminaria*).

Bertrand and Mokragnatz (6), in 1922, report the finding of 0.0136 to 0.0174 gm. of nickel per kilo in samples of arable soil. These same authors, analyzing the ash of twenty samples of raw foodstuffs, found nickel in every sample. The foods studied include carrot (root), onion (bulb), potato (tube), spinach (leaf), lettuce (leaf), cress (leaved stalk), tomato (fruit), apricot (fruit), beans (young with entire pod, mature seeds), lentil (seed), buckwheat (seed), wheat (seed, bran), oats (seed), corn (seed), rice (decorticated and polished seed), and mushrooms. The amount of nickel in these foods ranged between 0.01 mg. per kilo of fresh material in tomatoes and 2 mg. per kilo in peas. Vernadsky (2) found nickel in mosses and in various organisms; he also reports two women investigators as having found nickel in a number of plants near Kief and in the ashes of the domestic mouse.

These various references indicate how widely distributed nickel is in nature and demonstrate clearly that a man on a mixed diet must habitually ingest small amounts of nickel.

Nickel may be present incidentally in hydrogenated fats as a result of its use as a catalyzer in their preparation. Offerdahl (7), in 1913, in about 200 determinations over a period of a year and a half never found more than 4 mg. and usually only 0.5 to 2 mg. of nickel per kilo in fat. Ellis (8), in 1914, found 0.02 to 0.075 mg. of nickel per kilo in hydrogenated cotton-seed oil, and 0.017 to 0.1 mg. in palm-kernel oil. Bordas (9), in 1919; in a report presented to the Superior Council of Public Hygiene (France) on the suitability of various hydrogenated oils for human consumption and the possible toxicity of a small amount of nickel contained therein, says that the nickel content of hydrogenated oils is of the order of 1 mg. per kilo.

Riess (10), in 1919, in a paper dealing with this subject, reports the finding of practically negligible amounts of nickel in hardened cotton-seed, peanut, linseed, and whale oils. A commercial sample of hydrogenated arachis oil contained 1.8 mg. of nickel per kilo. Rost (11), in 1920, reports minute quantities of the metal in hydrogenated cotton-

seed, arachis, linseed, and sesame oils. The amounts of nickel ingested by man from this source are, however, so insignificant that further discussion is unnecessary.

Larger amounts of nickel may, however, be present in foods which have been cooked in nickel utensils. This matter we will consider at length in our discussion of the physiologic action of nickel on man.

II. Biologic Action of Nickel

A large amount of experimental data exists dealing with the action of metals and of metallic salts on biologic material. In a general review of the action of nickel it is of interest to us to consider briefly the effect of nickel and its compounds on micro-organisms; on single cells, such as erythrocytes; on plants; and on lower animal forms.

A. Micro-Organisms

Schulz (12), in 1882, investigating the antiseptic effect of nickel chloride, reports that 1 per cent. nickel chloride will prevent putrefaction of blood and fibrin —an action which he attributes to the liberation of chlorine. Geerkens (13), in 1883, tested the effect of nickel carbonate and of nickel chloride on retarding the putrefaction of fibrin, and of nickel chloride on the putrefaction of blood and of fresh muscle allowed to stand in a solution of the test salt. He also studied the effect of nickel chloride on the growth of mold and on *Paramecium*. This author concludes that nickel salts, especially the chloride, show very distinct antiseptic power. They are able to delay for some time the putrefaction of animal material, but they lessen only moderately the growth of mold on vegetable substances.

Chassevant and Richet (14), working with a variety of metallic salts including those of nickel, determined that the action of a metallic salt on lactic acid fermentation in milk is dependent on its concentration. If the concentration of the metallic salt is gradually increased from zero, the substance will first affect the rate of reproduction of the bacteria, and when a certain definite quantity has been added no further reproduction will take place (antigenetic concentration). If the concentration is further increased, the production of lactic acid will be lowered and a second point will be reached where fermentation will cease (antibiotic concentration). The antigenetic concentration of nickel salts expressed in mols is 0.000125; its antibiotic concentration, 0.0002.

Isachenko (15), investigating the influence of metals on the virulence of bacteria and on their growth and general activity, reports that nickel-plated vessels are absolutely unsuitable for growing and transporting bacteria because of the effect of the nickel in inhibiting bacterial growth. Manoilow (16), in 1907, found that nickel salts are less destructive to and have a weaker inhibiting action on the growth of micro-organisms than have copper and other metals. Hotchkiss (17), in 1923, studying the stimulating and inhibiting effects of certain cations on bacterial growth, determined that in very low concentrations nickel chloride, along with other metallic chlorides, exerts a stimulating influence on the growth of *Bacillus coli*, but in higher concentrations completely inhibits the growth of this organism.

These experiments and other similar ones (18) demonstrate that nickel salts in low concentrations are not harmful but are even stimulating to bacterial growth, but that in higher concentration the salts of this metal, in common with

other metallic salts, are toxic to microorganisms.

B. Erythrocytes

Hausmann and Kerl (19), studying the action of finely divided metals on red blood cells, demonstrated that, when metals such as silver, cadmium, copper, magnesium, lead, tin, zinc, and nickel are applied to blood agar plates, local areas of hemolysis of the corpuscles in the agar are produced. Schürmann and Baumgärtel (20) report that the salts of copper, nickel, and iron possess a marked ability to agglutinate red corpuscles *in vitro*, both experiments suggesting that nickel, in common with other metals, is toxic to isolated blood cells.

C. Plants

In 1890, Haselhoff (21), becoming interested in the effect of nickel on plants because of serious complaints from farmers whose lands bordered on streams containing waste water from nickel-ore-crushing works, undertook a series of investigations on the effect of nickel on the growth of horse beans and of corn. The usual methods of water culture were followed. In making the solutions nickel sulphate was used, 1 c.c. of solution representing 1 mg. of nickel oxide. The author tested the effect in the water cultures of 2.5, 5, 7.5, 10, and 50 mg. of nickel oxide to each liter of nutrient solution. The horse-bean plants grown in solutions containing nickel soon became spotted, turned yellow, their flowers fell off, and, on the whole, their condition was very unsatisfactory, all dying in from twelve to fifty days. The effect on the corn was very like that on the beans. At the end of seventy-two days all the plants treated with nickel oxide were dead, while the check plants were still sound and growing. Haselhoff concludes that the effect of nickel salts on the growth of plants is very injurious, no matter how small may be the quantity of nickel.

Coupin (22), working in 1901, placed young shoots of wheat in graded solutions of nickel and of cobalt in distilled water and determined the weakest solutions in which the plants died (*l'équivalent toxique*). For nickel he gives the following toxic equivalents: $NiCl_2$, 0.02; $NiSO_4$, 0.022; $Ni(AgO_3)_2$, 0.1. The third substance he describes as toxic, the first two as very toxic—many of the plants dying within ten days.

Later investigators, however, report results at variance with those of Haselhoff and Coupin. Albano (23), in 1915, working on the effect of fertilizers and stimulants on the growth and production of Chinese hemp, concluded from his experiments that the only chemicals the use of which as growth stimulants to this plant can be recommended as likely to be profitable are iron and very dilute nickel. Free (24), in 1917, tested the effect on *Pelargonium zonale* and other plants of a variety of elements, including nickel, in different concentrations. According to this observer, nickel showed no determinable poisonous effect for any concentration with any plant employed. Other studies on the effect of metals on plants are listed in the bibliography (25).

D. Worms

Ariola (26), investigating the toxicity of metallo-albumins, prepared by beating egg albumin with metallic powders, determined that the metals, arsenic, nickel, antimony, iron, copper, and cobalt, are toxic to vinegar eels, a small nematode worm. The toxicity of the metals increases in the order given.

Other papers of possible interest in a study of the biologic action of nickel are listed under bibliographic reference (27).

III. Physiologic and Toxicologic Action of Nickel

A very considerable amount of investigative work has been done on the physiologic and toxicologic actions of nickel, and from various points of view. Many investigators have been concerned with nickel only as one of the metals; another large group of workers, stimulated by the practical question as to whether or not a toxic amount of nickel is taken up by foods cooked in nickel utensils, have studied extensively the corrosion of nickel pots by foods cooked in them, have administered nickel in various doses to frogs, pigeons, guinea-pigs, rabbits, cats, and dogs, and to man, and have combined the two types of investigation by feeding to animals or by eating food cooked in nickel utensils and observing the results. Much of this work was done between the years 1883 and 1900. It was not until 1905, however, when Tschugaeff (28) first reported the use of di-methyl-glyoxime as a reagent for nickel, that an even approximately satisfactory method for detecting this metal in minute amounts was used; therefore, earlier reports of positive or negative findings of nickel in foods, excreta, and autopsy material must be considered with this fact in mind. In reviewing the great mass of data—often confused and discordant—which exists concerning the physiology of nickel, let us begin with the work on frogs, and then proceed upward through the various laboratory animals to man.

1. *Action of Nickel on Laboratory Animals*

A. Fish

Richet (29) tested the comparative toxicity of different metals by plunging fish into solutions of different concentrations of the chlorides of the test metals. He denominated as the "limit of toxicity" that concentration of metallic salt which permitted the fish to live more than forty-eight hours. The limit of toxicity of nickel chloride was determined to be 0.125 gm. of metallic nickel per liter of water, nickel in these tests being less toxic than copper, zinc, iron, or cadmium. Thomas (30), 1924, working on the absorption of nickel by *Fundulus heteroclitus*, concluded that *Funduli* absorb considerable nickel from solutions of the chloride in sea-water without evidence of intoxication. In fresh water, however, nickel chloride is toxic even though the fish are accustomed to fresh water.

B. Frogs

Stuart (31), in a thesis on the physiologic action of nickel and cobalt on the animal organism, published in 1883, reports the administration of nickel oxide (this author used a double salt, the only active constituent of which was nickel oxide) to frogs, fish, pigeons, rats, guinea-pigs, rabbits, cats, and dogs. Nickel oxide injected into the dorsal lymph sac of frogs caused a curious dark color of the skin, twitching of the muscles, and tetanic attacks resembling strychnine poisoning, followed by voluntary motor paresis going on to complete paralysis, the result probably of excitement of the spinal centers, succeeded by their paralysis. The heart beat more slowly, and finally failed, probably because of a fall in blood pressure from vasomotor paralysis of the abdominal vessels. Meanwhile respiration had failed. The digestive tract showed, at most, a slight congestion. The lethal dose of nickel oxide for frogs, given as nickelous oxide per kilo of body weight, was 0.08 (*i. e.*, 0.0024 gm. for an ordinary frog weighing 30 gm.).

Geerkens (13), in 1883, injected nickel acetate subcutaneously into frogs in doses of from 0.01 to 0.025 gm., the animals dying with symptoms of increasing cardiac paralysis. Coppola (32), injecting nickel chloride subcutaneously, obtained in frogs no convulsions but an immediate paralysis or "annulment of movements," which he attributes to the toxic action of the drug on the motor end-plates. This author gives the minimum lethal dose of chloride of nickel for frogs weighing 18 to 30 gm. as 0.003 to 0.004 gm.

Fede and Iappelli (33), using nickel sulphate in subcutaneous doses of from 0.005 to 0.05 gm., found that the smaller dose had no effect unless repeated, while 0.05 gm. caused marked convulsions at once. No dose of less than 0.02 gm. was immediately fatal. Postmortem examination showed marked vascular dilatation, especially in the hind limbs and in the alimentary canal, with a serous exudate in the tissues and a red froth in the intestinal tract.

Hare (34), injecting nickel bromide (3 grains) into a frog's leg, obtained a loss of function of both afferent and efferent nerve fibers, while the same dose injected into the trunk caused progressive failure of reflex motion. Laborde and Riche (35), after the subcutaneous administration to frogs of nickel sulphate in doses of 0.0625 to 0.125 gm., estimated as metallic nickel, obtained a constant modification of the heart beat, consisting in the production of longer and longer intermittences between double contractions and finally diastolic arrest of pulsation. Greco (36), in 1898, repeated practically the experiments and findings of Fede and Iappelli—small doses of nickel sulphate causing convulsions, larger doses causing paralysis and death. Oswald (37), in 1922, administered hexamine nickel bromide to frogs in the dose of 0.26 gm. per kilo of body weight, obtaining general paralysis, increase of corneal reflexes, tremor, tonic contractions of the finger extensors, tonic cramps in the muscles of the extremities, and exaggerated reflex irritability. Recovery followed on the next day though the exaggerated reflex irritability lasted some time.

C. Birds

According to Stuart (31), nickel oxide administered subcutaneously to pigeons causes first dulness and stupor, then feebleness of voluntary movements, jerking of different sets of muscles, unsteadiness of motion, paralysis, and death. The lethal dose of nickel for pigeons, given as nickelous oxide per kilo of body weight, is 0.060 gm. With the idea of determining whether or not nickel and cobalt have an hematogenic action, Pitini and Messina (38) administered chlorides of these metals to hens, rabbits, and dogs. Red blood counts on the hens showed insignificant variations during the dosing. Hemoglobin determinations by the Fleischl method on all the animals showed an average increase in hemoglobin of 13 to 14 points in the reading. The doses varied from 0.05 to 0.15 gm. daily for five to eighteen days. The authors conclude that the toxicity of iron, nickel, and cobalt stands thus: Fe < Ni < Co; and that the hematogenic power of these substances stands in the inverse order.

Hanzlik and Presho (39), studying the comparative toxicity of the heavy metals for pigeons, administered to three pigeons, respectively, the following doses per kilo of metallic nickel introduced into the gizzard: 0.947; 2.693; 2.36 gm. Not one of these doses was fatal.

D. Rodents

As long ago as 1826, Gmelin (40) re-

ported that nickel sulphate introduced into the stomach of rabbits caused an inflammation of the stomach and death with convulsions, but if introduced subcutaneously it had no effect. Stuart (31), in the work which we have already quoted, reports drowsiness and apathy in rats and guinea-pigs following subcutaneous injection of small doses of nickel oxide. Larger doses are followed by a period of motor excitement—irregular twitchings and jerkings of different sets of muscles, unsteadiness of motion, chorea-like tremor of the whole body, even perfect tetanic attacks—which is followed by motor paralysis and death. Acute poisoning in rabbits following intravenous administration of nickel oxide causes convulsions, diarrhea, paralysis, and death. In subacute or chronic cases the paralytic symptoms are less marked; the symptoms of excitement are more marked, more varied, and more persistent, and are accompanied by loss of appetite, emaciation, and anemia. Autopsy discloses destruction of tissue and hemorrhages in the stomach and to a certain extent in the intestines. The bile contains nickel. The lethal dose of nickelous oxide per kilo of body weight is 0.03 gm. for guinea-pigs, 0.025 gm. for rats, and 0.009 gm. for rabbits.

Geerkens (13) found that 1 gm. of nickel acetate given to a rabbit in a single dose by mouth was fatal, while half this dose was borne. An intravenous injection of 0.4 gm. caused death with the symptoms and autopsy findings characteristic of arsenic and sublimate intoxication. Autopsy findings in poisoned rabbits showed constant inflammatory changes in the stomach and intestines. In one case, the liver and spleen were bloody; in another, the lungs and liver. No mention is made of pathologic changes in the kidney. Fede and Iappelli (33), administering hypodermically fatal doses of nickel sulphate to rabbits (fatal dose, 1 gm. of 10 per cent. solution repeated in one hour; no effect except hyperemia of ears from a single dose) and to guinea-pigs (1 gm. of 10 per cent. solution), found at autopsy hyperemia of the abdominal vessels, inflammatory changes and bloody exudate in the alimentary canal, serous exudate in the peritoneum, and all the viscera, especially the liver and the lungs, congested.

Riche (35) fed guinea-pigs a solution of nickel sulphate containing 0.05 gm. of salt per cubic centimeter by adding it to the bran and flour of their diet. Treatment lasted over three months, the daily dose being increased from 0.5 to 5 c.c., representing a total of 26.3 gm. of nickel sulphate or 5.57 gm. of metallic nickel. A certain amount was lost but the greater portion was eaten by the pigs. Analysis of the excreta for periods of three days, made eight times, showed considerable quantities of nickel, varying between 0.005 and 0.075 gm. The appetite of the animals remained excellent. In one pig which died of pneumonia, 0.004 gm. of nickel was found in the lungs and 0.007 gm. in the liver. Riche and Laborde (35), after administering sulphate of nickel subcutaneously, intravenously, and by mouth to rodents and to mammals, conclude:

> Nickel in solution (sulphate) produces true toxic effects only when introduced into the organism by means of hypodermic injections (guinea-pig, rabbit) or when injected intravenously (dog) in relatively large dose, averaging from 0.5 to 1 gm. of active principle per kilogram of animal.
>
> In these experimental conditions, after provoking the maximum effects, the characteristic phenomena are as follows: convulsions and tetanic rigidity in a first period (rodents), vomiting and diarrhea (dog), weakness followed by paralytic collapse; finally, a terminal asphyxial period with visceral lesions and alterations of the blood characteristic of asphyxia. . . . . .

The physiologic mechanism of the action of nickel in the production of the essential symptoms, notably vomiting and the cardio-pulmonary effects, seems to reside in a predominating influence on the bulbar center.

The blood findings on hens, rabbits, and dogs reported by Pitini and Messina (38), following injections of nickel chloride, have already been referred to.

Chittenden and Norris (41), with the design of studying the distribution of absorbed nickel and cobalt, injected pure cobalt and nickel nitrates into rabbits and after the death of the animals analyzed the various organs for these two substances. The daily doses of nickel ranged approximately from 0.2 gm. to 0.8 gm., the small doses being given at the beginning of the experiments and larger ones as the experiments proceeded. Nickeled rabbits died after the following total doses respectively: 3.1 gm. (seventh day), 2.5 gm. (sixth day), 3.15 gm. (ninth day), and 1.8 gm. (sixth day). Analyses of organs after death led the authors to the following conclusions:

The storage power of the individual organs is somewhat peculiar. The spinal cord and brain, in the majority of the experiments, stand first in their power of picking up and retaining nickel and cobalt.

This is in close accord with work on arsenic. Muscle tissue shows a large affinity for nickel and cobalt, retaining a larger percentage of the metals than either the liver or the kidneys. In all of the experiments but one, a much larger amount of the poison was found in the muscles of the back than in the muscles of the leg.

Another striking feature in the storage of nickel and cobalt by the tissues, is the comparatively large amount retained by the lungs and heart, the amount found in these organs generally exceeding the amounts stored up in the liver and kidneys.

An experiment in which nickel nitrate was injected into a rabbit in increasing doses (amounts not given), and the urine from the animal collected and analyzed during the course of the nickel administration, gave the following results: The first twenty-four hours' urine (25 c.c.) contained 1.6 mg. of nickel, while the portion (70 c.c.) passed during the twenty-four hours preceding death contained 8.1 mg. of nickel; 3.5 gm. of feces excreted during the last twenty-four hours contained 17.5 mg. of nickel.

Chittenden and Norris conclude from their experiments that soluble nickel and cobalt salts are possessed of decidedly toxic properties, but that their poisonous action is somewhat slow and is manifested only when comparatively large amounts of the salts are administered. Both salts cause death apparently by stopping the heart. They also produce more or less disturbance in the alimentary tract, interfering with digestion, producing more or less inflammation of the mucous membrane of the stomach and intestines, and causing a somewhat persistent diarrhea. Unlike uranium, these salts have no apparent action on the kidneys or the liver, sections of hardened tissue from these organs showing no change of structure. In every case the urine of the poisoned animal was entirely free from albumin and sugar throughout the experiment.

Both salts tend to produce a paralysis of the extremities, possibly more pronounced with cobalt than with nickel. They enter the circulation quickly, are rapidly distributed to all parts of the body, and are, in turn, more or less rapidly eliminated by the kidneys. A considerable amount, however, evidently passes directly through the alimentary tract and is excreted through the feces.

Both salts appear to raise the body temperature quite decidedly, the rectal

temperature rising even 2° or 3° C. The blood vessels of the ears, on the contrary, quickly become constricted under the influence of the salts and the ears appear white and quite cold.

Massol and Breton (42), in 1909, suspecting metallic contamination of culture medium with which they were working, detected copper from the apparatus and then tested with different metallic salts to see if they could secure the toxic effect of the copper observed in their animals. Two cubic centimeters of an 0.85 per cent. sodium chloride solution of 0.1 mg. of nickel sulphate injected into the brain of a guinea-pig caused acute edema of the lungs and death in five minutes. Two cubic centimeters of a sodium chloride solution of 0.05 mg. of nickel sulphate, similarly injected, caused acute edema of the lungs and death in ten minutes. The authors suggest this experiment as a test means of proving metallic contamination of filtration apparatus.

E. Cats and Dogs

Gmelin (40), in 1826, fed or injected nickel sulphate intravenously into dogs. The feeding of nickel sulphate caused vomiting; the injection of it in large quantities caused immediate death, due to loss of irritability of the heart. When it was injected in less quantity, there resulted reduced activity of the nervous and vascular systems, vomiting and diarrhea, and a general cachexia, evidenced by considerable loss of weight and a purulent secretion of the conjunctiva. Orfila (43), evidently taking Gmelin's work as his authority, is quoted by Geerkens as writing in his "Toxicology:"

> When nickel sulphate is introduced into the stomach of a dog it causes vomiting. When fairly large doses are injected into the vascular system they cause immediate death; but if smaller doses are so injected they cause vomiting, loss of weight, physical weakness, and general cachexia.

Stuart (31), in the work already referred to, summarizes as follows the work of Huseman (44), Bucheim (45), and Azary (46). According to Huseman, in acute poisonings with 1 to 3 drams of nickel sulphate there is irritation and corrosion of the intestines, great secretion of bile, and death with vomiting and convulsions. Bucheim says that small doses of nickel and cobalt salts introduced into the alimentary canal do not induce symptoms of poisoning. In acute cases of poisoning by nitrates of nickel and cobalt, Azary found stupefaction and lowering of the temperature, slowing and weakening of the heart's action and of respiratory movements, and dilatation of the pupil. In chronic cases there was emaciation. The urine increased three or four times, with a specific gravity which might exceed 1049. Albumin and hyaline casts might be present. In the dog the pulse was first accelerated and the blood pressure rose; then the pressure fell, the pulse slowed, and the heart ceased to beat. The hemocytes swelled, lost their pigment, and became transparent sacs. Dragendorff (47) quotes Azary as reporting in 1878, in a speech given before the Professional Assembly of the Hungarian Scientific Society, that relatively small amounts (0.1 to 1 gm.) of the compounds of nickel and cobalt may cause acute poisoning and death due to disturbances of nutrition, following severe catarrh of the stomach, marked degeneration of the kidneys, and sometimes pneumonia. These compounds destroy blood cells, which swell, burst, and lose their hemoglobin. The action of the heart is decreased and very soon stops. Nickel and cobalt are excreted through the intestines and the kidneys.

Stuart (31), himself, injecting nickel oxide intravenously into cats and dogs, obtained with a rapidly lethal dose violent retching and vomiting; long, labored respirations; strong, regular heart beat; convulsions separated by periods of complete voluntary motor paralysis; and, finally, failure of respiration, with the heart beating some time after the respiration ceased. A marked fall in blood pressure occurred on injection of the solution. In cases of subacute or chronic poisoning, Stuart reports loss of appetite, violent retching and vomiting, diarrhea, tenesmus, emaciation, great thirst, blackening of the teeth, softening of the gums, and a foul odor from the mouth due to constant eructations of gas from the stomach because of undigested, putrefying food. The nervous symptoms are striking and are similar to those seen in rabbits. The alimentary tract symptoms are more prominent in cats and dogs, however, than in rabbits. The lethal dose of nickel oxide for cats is 0.01 gm. per kilo of body weight; for dogs, 0.007 gm.

Absorption of nickel administered *via* the stomach is, according to Stuart, slow and somewhat difficult. A dog, for example, given by mouth 500 mg. of nickel oxide per kilo in small doses within fifteen days, showed only slight vomiting. Excretion of nickel and cobalt, in Stuart's opinion, is chiefly by the kidneys, since these metals may be detected in the urine for many days following a single dose. Some of the metal is, however, excreted by intestinal secretion, nickel having been found high up in the cecum of rabbits killed soon after subcutaneous or intravenous injection.

Schulz (48), in 1882, fed a dog during the course of three weeks a total of 10.5 gm. of nickel acetate (daily doses of 0.5 gm.) without its health being affected in the least. On the contrary, the dog increased 1 kg. in weight.

Geerkens (13), in an inaugural dissertation entitled "An Experimental Investigation on the Action of Nickel Salts," published in 1883, reviews the literature on nickel which had appeared previous to this time and presents experiments of his own—some of which have already been referred to—on the effect of nickel on micro-organisms and on a variety of laboratory animals. In his review of the literature, Geerkens quotes von Hasselt (49) as saying:

> Nickel salts are very similar in their action to the salts of iron and manganese (Simpson). The dose of 3 grains of nickel sulphate causes severe vomiting but is not a powerful poison, resembling in its action the compounds of copper and of zinc.

Geerkens (13), himself, daily for twenty-nine days, gave a dog 0.5 gm. of nickel acetate (total dosage, 14.5 gm.) with the meat of rabbits which had died of nickel poisoning. The animal experienced a slight loss of appetite and two days of diarrhea but gained 1,230 gm. during the period of feeding. During ten days following the experiment, the dog lost 123 gm. in weight but showed no significant symptoms.

Fede and Iappelli (33) report three experiments on the administration of varying amounts of 2 and of 10 per cent. solutions of nickel sulphate by mouth or subcutaneously to dogs, with results varying from slight loss of weight to death in two days, depending on the dose. Autopsies on the dead animals showed catarrh of the intestinal tract, small hemorrhagic spots in the lower ileum, and general vascular dilatation. The authors conclude from their experiments that the most important phenomena of nickel poisoning are:

1. Vascular dilatation and weakening of the cardiac muscle up to arrest of the heart

in diastole, with the great diminution in blood pressure which is the necessary sequence.

2. Weakening up to complete abolition of the voluntary movements through a state of progressive paralysis of all the muscles of the trunk and limbs.

3. Diminution in the frequency and depth of respiration up to complete cessation.

4. Conservation, even exaggeration in the first place, of reflex movements.

5. Constriction of the pupil.

According to Coppola (32), nickel salts, even in very dilute solutions, administered by mouth cause repeated and violent vomiting in dogs. Small doses are eliminated in this way and the animal recovers. After large doses, the animal dies after two or three days from an acute gastro-enteritis. Hypodermic doses cause, first, vomiting, followed by a more or less liquid diarrhea, with accelerated respiration and contraction of the pupil. A fall in blood pressure occurs, due to weakening of the heart muscle. Repetition of the doses causes more diarrhea, weaker heart beat, less frequent labored respiration; and, if the injection is made into a limb, it becomes paralyzed. No tetanic convulsions occur. Sensibility and intelligence remain normal. Respiration and the heart fail, and death ensues. After an intravenous dose, the same result occurs. Autopsy shows the ventricles arrested in diastole but the auricles pulsating. The vessels of the intestinal tract are injected, the mucosa red and ecchymotic.

When nickel and cobalt are administered by mouth, their elimination, according to Coppola, is almost exclusively by way of the feces and only in small part by way of the urine. If these drugs are administered hypodermically or intravenously, the urine contains a large proportion but the feces still eliminate the greater part, the drug in the circulating blood being excreted into the intestinal tract by way of the digestive juices.

Hare (34), writing in 1886, reports experiments in which the administration of 15 grains of bromide of nickel, injected into the jugular vein of a dog, caused instant stoppage of the heart. Even 1 to 2 grains produced a fall in heart rate and in blood pressure.

Van Hamel Roos (50) at the Sixth International Congress for Hygiene and Demography held in Vienna in 1887, in discussing an Austrian law forbidding the use of nickel utensils, quoted Schulz's experiment in which a dog received daily 500 mg. of nickel acetate up to a total quantity of 10.5 gm. without its health being affected. Roos also reported an experiment of his own in which a dog received in thirty-four days 16.926 gm. of nickel acetate (5.642 gm. of metallic nickel). The daily dose, given in solution and mixed with the food, was the equivalent of 0.166 gm. of metallic nickel. The animal gained 7.5 per cent. in weight and showed not the least symptom of poisoning. In the words of the author, "l'animal était gai et se portait à merveille." When the dog was killed, the autopsy showed no abnormal or pathologic condition. Chemical analyses of the liver and kidneys showed non-weighable traces of nickel.

Riche (35), in 1888, reported experiments on the feeding of nickel salts to dogs. In one experiment which lasted for 160 days the animal received a total of 100.75 gm. of nickel sulphate, or 21.35 gm. of metallic nickel. The daily dose which was administered as a paste with the food varied between 0.25 and 2 gm. of the salt. When a dose larger than 0.5 gm. was given, loss of appetite, vomiting, and diarrhea appeared, and at one stage of the experiment even paralysis of the hind limb. When the dose was reduced to 0.5 gm. of sulphate (approxi-

mately 0.01 gm. of nickel) the animal became entirely normal. According to the author, the corresponding dose for a man weighing 70 kg. would be about 0.7 gm. of nickel (3.33 gm. of salt) a day.

After 160 days of treatment, ninety of which were intensive, the animal was killed and showed no pathologic lesions. Analyses of organs gave the following results:

	gm.
Urine in bladder	0.001
Kidneys	0.002
Blood (about 150 gm.)	0.002
Lungs	0.002
Heart	0.002
Intestines	0.002
Muscles of thigh and leg	0.004
Liver	0.008
Bone (about 1 kilo)	0.002
Brain and nervous system	0.007

Two determinations of feces gave 0.097 and 0.185 gm. "The metal also existed in the urine."

Riche as a result of his experiments makes the following statement: "In my opinion the ingestion of a salt of nickel does not present any more danger to the guinea-pig or the dog than a salt of iron."

The experiments of Riche and Laborde (35) in which nickel sulphate was injected subcutaneously or intravenously into rodents and into dogs have already been cited.[2] From the work in question, these authors concluded that nickel in solution (sulphate) produces true toxic effects only when introduced into the organism hypodermically or intravenously in relatively large doses, averaging from 0.5 to 1 gm. of active principle per kilogram of animal.

Chittenden and Norris (41), in reviewing previous experimental work on the physiology of nickel, cite the fact that Blake, in his study of the relationship between isomorphism, molecular weight, and physiologic action, groups nickel with manganese on account of its marked action on the nervous system. The New Haven authors also cite Woodman and Tidy as stating that vomiting is freely induced in a dog by a dose of 20 grains of nickel sulphate and that 10 grains introduced into the jugular vein will kill instantly. Brunton and Cash, according to Chittenden and Norris, found that nickel and cobalt cause a slight contraction of the blood vessels.

Rohde (51), also writing in 1889, reports an experiment in which he fed 15 c.c. of an aqueous solution of nickel acetate (0.2094 gm. of nickel) to a dog, and states that he recovered from the black-colored stools the exact amount of nickel fed to the animal.

Following the administration of nickel sulphate by mouth to dogs, Greco (36) observed: after small doses continuing over several days, diarrhea, loss of weight, cachexia, and death; after larger single doses (in one case 0.5 gm.), in a few minutes, vomiting, diarrhea, symptoms of acute gastro-enteritis, and death. Following the subcutaneous injection of 0.15 to 0.2 gm. of nickel sulphate, the same gastro-enteric symptoms occurred as followed mouth administration. Greco believed, however, that the early vomiting following hypodermic injection was due to an effect on the vomiting center, while the later vomiting was due to irritation of the gastro-intestinal tract by nickel excreted *via* this route. His opinion was supported by the fact that he detected nickel chemically in feces and in vomited material following hypodermic injection of nickel sulphate.

Further symptoms of nickel poisoning in dogs observed by Greco were: increase of all the secretions (urine and saliva), increase of peripheral temperature, paralysis of voluntary muscles, a

[2] See pp. 314-315.

fall in blood pressure due to dilatation of the vascular bed, and cardiac paralysis. In dogs the convulsive stage seen in frogs poisoned with nickel is almost lacking. Greco reports the following

TABLE I.—SUMMARY OF EXPERIMENTS BY DZERZGOWSKY AND HIS ASSOCIATES ON THE ADMINISTRATION OF NICKEL SALTS TO DOGS[1]

NICKEL SALTS USED	NUMBER OF DOG	DAILY DOSE	TIME	TOTAL NICKEL SALT SOLUTION	TOTAL DOSE METALLIC NICKEL	WEIGHT OF DOG AT BEGINNING OF EXPERIMENT	WEIGHT OF DOG AT END OF EXPERIMENT
		c. c.	*days*	*c. c.*	*gm.*	*pood-funt*[2]	*pood-funt*[2]
Lactate	1	10	208	2080	10.40	1–23	1–20
	2	20	208	4160	20.80	1–14	1–12
Acetate	1	10	211	2110	10.55	2–27	2–19
	2	20	211	4220	21.10	2–2	1–32
Tartrate	1	10	216	2160	10.80	1–4	1–4
	2	20	216	4320	21.60	1–26	1–25
Citrate	1	10	220	2200	11.00	2–3	1–39
	2	20	220	4400	22.00	2–12	2–2
Von Heldt	1	10	227	2270	11.35	1–2	1–0
	2	20	227	4540	22.70	0–37	0–37
Isobutyrate	1a	10	69	690	3.45	2–37	2–25
	1b		141	2552	12.76	1–7	1–6
	2	20	227	4340	21.70	2–2	1–36

[1] No nickel was found in the urine during the course of the experiments or in the organs at autopsy.
[2] One pood = 36.113 lb.; 1 funt = 0.90283 lb. (*i. e.*, 40 funt = 1 pood).

autopsy findings in one dog which had died of nickel poisoning: a gastro-intestinal mucous membrane strongly injected and showing ecchymotic spots and a brain showing venous stasis with punctiform hemorrhages in the central mass.

The work of Pitini and Messina (38) on the hematogenic power of nickel and cobalt administered to hens, rabbits, and dogs has already been summarized.[3]

Dzerzgowsky and his associates (52), in a paper published in 1906 on the effect of nickel salts on the animal organism, state that the purpose of their research is to answer two questions: (1) What is the maximum amount of nickel which will go into solution or be taken up by various foods during cooking in nickel utensils? (2) Are the amounts of nickel which go into solution under these conditions harmful to the animal body if taken over continuous periods? Following a series of experiments on foods cooked in nickel pots — experiments which we will discuss later—these investigators fed dogs daily doses of 50 mg. and of 100 mg. of metallic nickel given in the form of the nickel salts of lactic, acetic, tartaric, citric, and butyric acids, and of the neutral nickel salts of von Heldt—an amount far above the nickel recovered from the most acid of the

[3] See p. 313.

foods cooked in nickel utensils in the first series of experiments. In Table 1 are summarized the facts and findings of their first work on dogs.

Two further series of experiments carried out on dogs by Dzerzgowsky and his associates were designed (*a*) to determine the maximum dose of nickel causing no abnormal symptoms when administered over periods varying from one to many days, and (*b*) to determine the maximum harmless single dose. It was found that single doses of 10.6 to 21.2 mg. of nickel salts, estimated as metallic nickel per kilo of weight, caused no symptoms; 22 to 44.1 mg. caused symptoms varying from vomiting and diarrhea to death. The authors believe that as long as the alimentary tract mucosa is intact there is capacity to get rid of the metal without absorption, but, if the mucosa is injured, doses of nickel which would otherwise be harmless will cause toxic symptoms. Continued administration of doses of nickel salts not large enough to cause injury, according to Dzerzgowsky, dull the sensibility of the nerve endings of the alimentary tract, making it possible for larger doses of the metal to be given without irritation. Dzerzgowsky reports that nickel was not found in the urine of his experimental animals during the course of the research nor in the organs at autopsy.

Lehmann (3), in 1909, in a paper entitled "Hygienic Studies of Nickel," published the results of an extensive series of experiments dealing with a method of nickel analysis, with the normal nickel content of vegetables and of animal organs, with the nickel content of foods cooked in nickel utensils and their use in the household, and with tests to ascertain the poisonous effect of nickel on cats and dogs when administered in small doses. In regard to these last experiments, Lehmann says:

> I avoided giving doses which no one doubted were harmful and also massive doses of several decigrams or grams per day because these doses had no practical hygienic interest. I was content with feeding doses of nickel which would several times exceed the maximum quantity (computed per kilo) reached by the consumption of foods containing nickel, prepared for human beings. Four to eight months was chosen as the duration of the test and the tests were started on young, partly grown animals. The nickel salts were always in the soluble state and were measured from a solution of known concentration and then mixed with the food. Dogs and cats were used. The animals received each morning milk without nickel; in the evening, the meal consisted of cooked horsefiesh containing the nickel salt. To avoid possible corrosive action, the doses were small at the start but they were soon considerably increased. Some animals showed a diminished appetite at the beginning of the test only and no symptoms of sickness were apparent at any time. They grew normally.

The salts used to adulterate the food were nickel chloride, nickel acetate, and nickel sulphate. Some of the cats were fed with food which was prepared in nickel utensils and to which no nickel had been added. The nickel content of this food was obtained by analyzing samples of it.

After presenting protocols and tables of experiments on cats and dogs giving the amounts of nickel administered, the duration of the nickel feeding, the weights of the animals at the beginning and end of the experiments, the autopsy findings, and the results of analyses of the organs for nickel, Lehmann sums up as follows the conclusions to be derived from his animal experiments:

> I do not hesitate to say that nickel in the form of acetate, chloride, and sulphate, when mixed with the food and eaten by the animals at the rate of 6-12 mg. of nickel per kilo of cat per day, for 100-200 days, does not cause the development of any visible symptoms which would lead one to believe that the

nickel was injurious to the health. The small, different pathologic conditions which were found in individual animals could be explained otherwise in a most satisfactory manner.

The results of the chemical examination of the organs of Lehmann's animals are most interesting. In most cases, the nickel content per kilogram of liver did not exceed 30 mg. This figure was exceeded four times. On three occasions the nickel content was, respectively, 51, 65, and 67 mg. Once a nickel content of 859 mg. was found. It seems certain that the high nickel content of the livers in question was not due to errors because the analyses were run in duplicate and the duplicates checked in each case. As a result of his findings, Lehmann established three categories from the standpoint of the behavior of the organs of his animals toward nickel:

1. Animals which absorbed and excreted nickel in small amounts only. The blood, bile, and urine, as well as the kidney and liver, contained only traces of nickel.

2. Animals which absorbed and excreted large quantities of nickel. The organs of the animals in this class did not contain much nickel. The bile, urine, and blood contained moderate amounts.

3. Animals which absorbed large amounts of nickel and excreted only a little (two cats in this category). Besides the liver and kidneys, the stomach, the large and the small intestines, the spleen, and finally the blood, were found to be very nickeliferous. The nickel content of the blood for these two cats was unusually high, *i.e.*, 135 and 320 mg., respectively, per kilo of blood—a fact which the author found difficult to explain. A tentative suggestion is offered, but no proof, that corrosion of the absorbing surfaces might have permitted the excessive absorption of nickel. In commenting on these two animals, Lehmann says:

> I think it best to refrain from further hypothesis relating to these two cases. I will here only state two facts. First, that the two animals did not show any indication of harmful effects due to this abnormal nickel content. Secondly, that I have observed in cats, which were fed with food containing copper, similar incomprehensible, or at least only hypothetically explicable, differences between the small number of exceptional animals and the ordinary animals under observation.

Lehmann concludes his paper with the following statement:

> . . . nickel when introduced into the body with the food in small quantities over a long period as a non-corrosive compound is entirely harmless, just as are copper, zinc, and tin, which, I may say, we consume in the household in far greater volume than we generally suppose.

Summary.—Cushny (53) summarizes the physiologic action of nickel upon laboratory animals as follows:

> Nickel and cobalt salts administered to the frog cause a curious dark color in the skin, followed by convulsive movements which at first arise apparently from the medulla and higher centers and resemble those of picrotoxin but later are reflex from excessive irritability of the cord. In mammals the usual symptoms arising from the action on the intestines and kidney are accompanied by tremors and chorea-like movements, later by tetanus and finally by paralysis. These metals also cause a profound fall in blood pressure resembling that from arsenic and apparently arising from direct action on the walls of the arterioles and capillaries.

Other articles of possible interest on the physiologic action of nickel on laboratory animals are listed under bibliographic reference (54).

2. *Action of Nickel on Isolated Tracts*

A. The Heart

Richet (55), in 1882, tested the chem-

ical action of different metals on the exposed heart of the frog by dropping on the ventricle four times during the course of an hour four drops of a neutral solution of the chloride of the metal in water. At the end of an hour the heart was washed with cold water. The "limit of toxicity" of a metal was the maximum quantity of the metal which had not definitely arrested the contractility of the heart two hours after the beginning of such an experiment. The limit of toxicity of nickel was determined to be 9.5 gm. of metallic nickel per liter of water. Nickel in this test proved much more toxic than copper or iron.

Voegtlin (56), in 1915, studying the mechanism of the toxic action of the heavy metals on the isolated heart determined that the lactates of copper, iron, nickel, cobalt, and aluminium, when added to Ringer's solution containing potassium chloride, calcium chloride, and sodium chloride, produce heart block and diastolic standstill. Washing with Ringer's solution is not followed by recovery unless small amounts of sodium carbonate or of sodium bicarbonate are added to the perfusion fluid. It is suggested that this antitoxic action is due to the dissociation of the metal-protein compound and the formation of the insoluble hydroxide, carbonate, or bicarbonate.

Salant and Connet (57), in 1920, studying the influence of heavy metals on the isolated frog's heart, found that a solution of nickel acetate, 1 to 10,000 in Ringer's solution, perfused through the heart for one minute, diminished the force of the beat by one-fourth to one-third and caused a moderate diminution in the frequency. In all cases, recovery took place soon after perfusion was discontinued. Complete abolition of heart action occurred with a concentration of 1 to 1,000 of nickel acetate even when the perfusion lasted only one-half minute. The authors represent the comparative toxicity on the heart of the metals studied as follows:

Fe, Mn, U < Ni, Co < Cu < Zn < Cd.

B. The Intestine

Salant and Mitchell (58), studying the influence of heavy metals on the isolated rabbit's intestine, found that zinc malate solutions (N/10,000) caused a depression of tonus and a decrease in amplitude of contraction within three minutes. The same concentration of nickel acetate sometimes caused primary depression for a brief period, usually followed by recovery and stimulation. Zinc is more toxic than nickel as shown by the greater injury produced and by the reaction of the intestine to barium chloride and to pilocarpine, response to these agents being obtained after treatment with a much more concentrated solution of nickel acetate than of zinc malate.

C. Formation of Antibodies

Walbum (59), investigating the influence of various salts on the production of antitoxin, showed that the chlorides of manganese, cobalt, nickel, and zinc augment the production of agglutinin and antitoxin in the goat and in the horse when these animals have been injected with the colon and the diphtheria bacillus, respectively. The amounts of salts used in the experiments were: for the goat, 25 c.c. of a 0.01 molecular solution; for the horse, 10 c.c. of a 0.5 molecular solution, calculated as hydrates. The salts were injected intravenously in single daily doses.

Madsen (60), in 1923, determined that daily injections of 0.05 gm. of the chlorides of manganese, zinc, nickel, cobalt, and other metals into goats that

had previously been immunized by specific agents served to maintain the antibody content of the blood at a high level. Similar results were obtained with the horse immunized against diphtheria. The author suggests that antibody formation is a secreting process and that the action of the metals is in the nature of a catalytic effect on enzyme processes.

3. *Action of Nickel on Man*

Man's possible sources of exposure to nickel are: (*a*) through skin contact with nickel salts in nickel plating; (*b*) through the inhalation of metallic nickel dust during the polishing of nickel; (*c*) through the inhalation of gas escaping during the manufacture of nickel carbonyl; (*d*) through the therapeutic administration of a compound of nickel—an almost obsolete medical practice; and (*e*) through the ingestion of nickel as a result of the normal presence of this substance in foods or because of its incidental presence there as the result of the manner in which the food has been prepared for consumption.

A. When in Contact with the Skin

a. Dermatitis from Nickel Plating.—The following paragraph is quoted from Kober and Hayhurst (61):

> The men engaged in nickel plating not infrequently develop a peculiar, eczematous, vesicular inflammation or ulcers of the skin affecting the hands and arms and occasionally also other portions of the body. The disease is attributed by some authors to the caustic action of nickel salts, especially nickel sulphate or nickel cyanide, employed in the electrolytic bath. Others hold that such agents as alkaline cyanides, caustic potash or soda, benzene, petroleum, soap, and lime, which are quite generally used in all plating processes, are responsible for the mischief, while still others maintain that it is the result of a combined action of various irritants. Whatever the exact cause may be, careful attention to the skin, in the way of cleanliness and the application of vaseline or cold cream, are indicated as protective measures.

Further details in regard to the cause, the type of lesion, and the treatment of nickel dermatitis may be obtained from the articles listed under nickel dermatitis (62) in the bibliography.

B. When Absorbed through the Respiratory Tract

a. Poisoning from the Inhalation of Metallic Nickel Dust.—Richter (63), writing in 1907, reports a case which he believed to be one of poisoning by metallic nickel dust. The patient was a metal polisher, polishing aluminium, copper, brass, but mostly nickel—very dusty work. A prodromal stage of general malaise was succeeded by severe colic, general cachexia, and anemia. It was Richter's opinion that metallic dust had accumulated in the patient's bowels and that some of it had passed through the intestinal walls, probably after the formation of a salt (oxalate?), or that some of it had been dissolved by the action of the hydrochloric acid of the stomach. Blood examination showed hemoglobin, 70 per cent.; normal erythrocytes; and a striking number of blood platelets in aggregations. "The masses of blood platelets (with very little blood pigment) may have been created by a poisonous action of the nickel salts. In consequence thereof, anemia and cachexia." The urine was of a pale greenish color and gave three qualitative tests for nickel, although the spectroscopic test was negative. The patient's co-workers complained of ailments which they believed to be due to aluminium dust. The author comments that possibly some other metallic dust had exerted an adverse influence, but he believed that the condition was due, in

the main, to absorption of metallic nickel dust from the intestinal tract, there being absolutely no symptoms from the lungs.

b. Poisoning from the Inhalation of Nickel Carbonyl.—The following account is taken largely from Kober and Hayhurst's (61) textbook of "Industrial Health." Nickel carbonyl ($Ni(CO)_4$) is a clear, pale, straw-colored liquid which boils at a temperature of 43° C. The process of manufacture of this substance was introduced in the beginning of the present century and about twenty-five workmen were poisoned by escaping gas, some fatally, before the toxic properties of the gas were recognized. In the milder forms of poisoning the men suffer from headache, giddiness, unsteady gait, nausea, and at times dyspnea, the symptoms disappearing quickly on removal to fresh air. In the more severe forms, the dyspnea, after a lapse of twelve to thirty-six hours, is increased, accompanied by cyanosis, a rise in temperature, and cough, with more or less blood-stained expectoration. The action of the heart is usually found to be increased, but is otherwise normal. Delirium is generally present. Some doubt exists as to whether any blood changes occur. Fatal cases usually terminate within three to eleven days but death may be instantaneous. Postmortem examinations show hemorrhages and edema in the lungs and hemorrhages in the white matter of the brain.

Armit (64) experimented on animals to determine: (*a*) whether the symptoms and lesions observed in nickel carbonyl poisoning are caused wholly or in part by the carbon monoxide of the compound; (*b*) whether nickel carbonyl is absorbed as such; and (*c*) whether the nickel of the compound is the toxic factor. He concludes that the poisonous effects of this compound are due to nickel and not to carbon monoxide, and thinks that the peculiar toxicity is caused by a deposit of nickel, as a slightly soluble compound in a very fine state of subdivision, over the immense area of the respiratory surface, where it is dissolved by the tissue fluids and is then taken up by the blood. The hemorrhages found after death are, in his opinion, caused by fatty degeneration of the vessel walls, the specific pathologic change having been set up by the nickel.

Further details of the manufacture of nickel carbonyl and of its toxicology and case reports of nickel carbonyl poisoning in industry may be obtained from the articles listed under nickel carbonyl (65) in the bibliography.

C. When Absorbed through the Intestinal Tract

a. Therapeutic Administration of Nickel.—In the medical literature appearing between 1850 and 1885 there are a number of reports of the therapeutic use of nickel. Simpson (66), in 1853, considered nickel sulphate a slight tonic useful in obstinate periodic headache and possibly in chlorosis. He is quoted by Geerkens (13) as using nickel sulphate in migraine and in amenorrhea. Palmer (67), in 1868, used nickel sulphate for neuralgia and sleeplessness in cases where opium failed, and observed in his cases no disturbance of the digestive tract. Broadbent (68), in 1869, is reported by Geerkens (13) as having used nickel chloride in leukorrhea and by Stuart (31) as having used nickel in cases where iron is generally employed. Doses of over 0.18 gm. sometimes caused vomiting.

Da Costa (69), in 1883, in an article entitled "Observations on the Salts of Nickel, Especially the Bromide of Nick-

el'' gives the dose of nickel sulphate as from 1 to 3 grains; 5 grains is possible, but causes giddiness and nausea. Nickel sulphate, according to this author, is a slight anodyne, causing no appreciable effect on pulse and temperature. Bromide of nickel has the effect of other bromides. Five to 7 grains is an average dose; 10 grains, a large dose. It does not act on the skin or the bowels or on the composition of the urine. Its effect on the nervous system is that of a sedative. Ten grains, three times daily, were once given for ten days in a case of epilepsy, no ill effects from the nickel being observed.

Stuart (31) quotes Huppert (70) to the effect that after the administration of nickel to men no nickel was found in the urine. Warnecke (71), according to Stuart, also found no nickel in the urine after the administration of nickel to men but did find nickel in the feces. In connection with such statements, we must remember the lack, at the time these papers were written, of a delicate test for nickel.

Scarman is quoted by Fede and Iappelli (33) as using, in mild epilepsy with intermissions, a dose of nickel bromide equivalent to 1.5 gm. of potassium bromide. Leaman (72), in 1885, used nickel bromide in cases of epilepsy, giving 5 to 10 grains three times a day. Testa (73), in 1886, after dosing animals for a month with nickel bromide and then testing the response of the motor cortex to direct stimulation, concluded that ''bromide of nickel can be considered an efficacious remedy in epilepsy since it diminishes, even to abolishing completely, the excitability of the cerebrum,'' and that nickel bromide in its anti-epileptic action is superior to potassium and to zinc bromide.

Kolipinski (74), writing in 1911 on the uses of nickel sulphate in medicine, gives the therapeutic dose of nickel sulphate as 1 grain after meals or food three or four times a day—a dose which is well borne. Two to 5 grains are apt to cause severe nausea and vomiting. According to this author, nickel sulphate in the proportion of 1 to 1,900 is a potent antiseptic and, because of its antiseptic properties, is useful in the treatment of parasitic skin diseases.

Offerdahl (7), interested in the possible utilization of whale fat as a food and wishing to test any possible harmful effects of nickel present in the fat following its use as a catalyzer, took daily for a month 0.5 gm. of powdered nickel, mixed with whale fat, but was unable to observe any bad results. This experimenter determined quantitatively the nickel content of his urine and feces and was able to recover 98 per cent. of the nickel which he had eaten.

Cushny (53), in his ''Text-Book of Pharmacology,'' in discussing nickel does not mention a single therapeutic use for this metal—an omission which indicates the entire unimportance from the modern viewpoint of nickel and its compounds as useful therapeutic agents.

b. Ingestion of Nickel in Food.—The discussion in an earlier section of this paper[4] on the widespread occurrence of nickel in small amounts in foodstuffs makes it clear that a man on a mixed diet habitually ingests small amounts of nickel. A minute quantity of the metal is present incidentally in hydrogenated fats as the result of its use as a catalyzer in their preparation,[5] and man, through this source, consumes an insignificant amount of nickel. The amounts of nickel ingested from these two sources are so small, however, that they have no real import from the point of view of their physiologic effect on man.

[4]See p. 309.
[5]See pp. 309-310.

When food is prepared in nickel cooking utensils, however, appreciable amounts of nickel are corroded from the pots and are ingested with the food. The knowledge of this fact, the knowledge of the toxic properties of nickel salts, plus the assumption that enough nickel was corroded from nickel cooking utensils during cooking to be dangerous to man, led to the passage of a law in Austria in 1886 against the use of nickel cooking utensils (75). This law was subsequently repealed (76) as the result of the work of various investigators who concluded from their studies that nickel cooking utensils are harmless from the point of view of health. It is of interest to us to consider in detail the studies which have been made on the corrosion of nickel utensils during cooking and on the amounts of nickel added in this way to food, together with the observations and the opinions of investigators as to the results of eating food which has been cooked in nickel utensils.

i. Corrosion of Nickel Cooking Utensils and Amounts of Nickel Added from this Source to Food.—Geerkens (13), in 1883, allowed 2 liters of fresh milk to stand eight days at room temperature in a nickel container. At the end of this time, the milk contained 0.028 gm. of nickelous oxide, or 0.022 gm. of metallic nickel.

Birnbaum (77), working in 1883 at the station for testing different foods and utensils, connected with the chemical laboratory of the Polytechnical Institution in Karlsruhe, made the following tests: Half a gram of salt was dissolved in 250 c.c. of vinegar (acetic acid, 3.5 per cent.) and the solution boiled in a covered nickel utensil (400 c.c.) for an hour. The green acid solution was allowed to stand in the vessel for two hours and was then tested for its nickel content. Analysis showed that 250 c.c. of vinegar had dissolved 0.095 gm. of nickel. On emptying the utensil, it was noticed that a red streak adhered to the inside of it at the line where the surface of the liquid had been in contact with the metal. Close examination showed that this streak consisted of metallic copper. A special test proved that the copper did not come from the underlying metal and that the coating consisted of pure nickel which adhered very strongly to the sheet iron. Several red lines led from the streak, already mentioned, to the points where solder had been used to attach the handles, and the copper had evidently come from there. The hard solder used to attach the handles had been attacked by the condensed vinegar vapors and the dissolved copper precipitated on coming in contact with the metallic nickel.

Another 250 c.c. sample of vinegar, containing 3.5 per cent. of acetic acid and 0.5 gm. of salt, was left standing in a similar nickel-plated vessel for twenty-four hours at ordinary room temperature. Analysis showed that the green solution contained 0.074 gm. of nickel.

The same vessel used in the preceding test was later half filled with sour cherries and boiled for half an hour. The under side of the cover and the inside of the utensil were coated with green basic nickel salts and dissolved nickel was present in liquid poured from the fruit.

These tests, according to the author, show that nickel-plated utensils yield, in all cases, small quantities of nickel to sour foods so that a nickel coating (5 to 20 per cent. of the sheet iron) will apparently be destroyed in a short time.

Riche (78), in 1888, compared the dissolving action of sodium chloride solution, vinegar, sodium carbonate solution, ammonia, red wine, and beer on

nickel, copper, tin, German silver, brass, an alloy of copper, zinc, and tin, on nickel money and on bronze money, giving figures for the amounts of metal recovered in the various solutions after

tartaric, lactic, and butyric acids were heated for three hours or were left for twenty-four hours at room temperature in nickel-plated vessels. The utensils used were of three sorts—nickel plating

TABLE 2.—DISSOLVING ACTION OF VARIOUS SOLUTIONS ON NICKEL (RICHE)

SURFACE OF NICKEL EXPOSED	SOLUTION USED	LENGTH OF EXPOSURE	AMOUNT OF NICKEL RECOVERED FROM SOLUTION
sq. cm.		*days*	*mg.*
80	10% sodium chloride	8	traces
80	10% vinegar	10	115.0
80	Wine (11% alcohol)	10	115.0
80	Beer	10	18.0
160	10% sodium carbonate	16	4.8
160	13% ammonia	5	11.0

varying periods of exposure to the metals. The surface of metal exposed was, in some cases, 80 sq. cm.; in other cases, 160 sq. cm. The periods of exposure varied from eight to sixteen days. The amount of nickel corroded was determined by an electrolytic method of analysis. The figures in Table 2 are illustrative of the results which were obtained by Riche.

The author comments on the fact that the corrosive action of the alkalies of nickel is inconsiderable. He also reports experiments with nickel crucibles used in both acid and alkaline fusions, and recommends this metal highly for use in the treating of materials with caustic soda or carbonate solutions or for the heating of inert materials to red heat.

Rohde (51), in an article published in 1889 entitled "The Corrosion of Nickel Cooking Utensils by Organic Acids," gives protocols of experiments in which 2 per cent. and 4 per cent. acetic, citric,

on steel, on copper, and on brass. A series of experiments was also performed with 2 per cent. and 4 per cent. acetic acid in pure nickel utensils. The losses of weight of the vessels were determined as well as the amounts of nickel recovered in the acids tested. Nickel was determined as nickel oxide by a gravimetric method of analysis. The results of the work showed approximately the same losses of weight in experiments done in the cold with 4 per cent. acid as with 2 per cent. A greater loss of weight occurred in the heating experiments with 4 per cent. acid when lactic, acetic, or butyric acids were used. Less loss of weight occurred, however, with the stronger citric and tartaric acids than with the weaker solutions. A greater loss of weight occurred in all the twenty-four-hour experiments in the cold than in the experiments with the same acids during three hours of heating. The loss of weight in the pure nickel pots varied between 2 and 7 mg.;

in the plated casseroles the weight loss varied between 5 and 33.5 mg. The amounts of nickel recovered from the test solutions were slightly less than the weights lost by the vessels.

During the course of the experiments, the utensils showed at first a slightly corroded, dull appearance, and toward the end of the research brownish-black spots sometimes appeared, probably due to iron impurities in the nickel.

Garnier (79), in 1890, at the request of a metallurgical society, investigated the question of the possible use of an alloy of "white bronze of nickel," containing 75 per cent. copper and 25 per cent. nickel, as a possible material for cooking utensils. The advantages of this metal were that it was more malleable and cheaper than pure nickel. Garnier exposed the utensil in question to the action of hydrochloric acid, acetic acid, caustic soda, salt solution, and to a mixture of salt and acetic acid for different periods of time and at different temperatures. Amounts of nickel varying from 0.009 to 1.754 mg. per liter of liquid were recovered from the test solutions. Copper was also recovered. The method of nickel analysis was an electrolytic one.

Ludwig (80) began, in 1895, a long series of tests on the use of nickel cooking utensils — experiments published three years later under the title, "Experiences with the Use of Nickel Utensils in the Household." For two and one-half years his entire family ate and drank, daily, food prepared only in nickel utensils. The Berndorf nickel utensils used in the tests contained 98 per cent. nickel and 2 per cent. other metals (copper, manganese, iron, aluminium, and cobalt). Food preparation was the same as in other utensils except that highly acid foods were removed from the nickel utensils as soon as cooked. Numberless samples of food and drink were analyzed for nickel during the two and one-half years. The method of nickel analysis was a gravimetric one. The nickel content of various foods cooked in nickel utensils in milligrams per 100 gm. of food was as follows:

	Nickel Content mg.
Tea infusion	0.0
Cooked milk	very small trace
Beef soup	0.2
Ham broth	0.37
Eggs	0.0
Beef, meat	0.9
Venison	1.9
Veal, roast	trace
Mutton, roast	trace
Peas	1.2
Lentils, acid	3.5
Lentils, cooked	2.4
Cauliflower	small trace
Cabbage	small trace
Sprouts	small trace
Sauerkraut	8.2
Beef, burned	trace
Fowl, burned	trace
Partridge	trace
Pheasant	trace
Carrots	1.3
Beans, green	trace
Spinach	2.6
Spinach	2.7
Peas	1.6
Sauerkraut	12.9
Sauerkraut	5.4
Sauerkraut	9.5
Essigkraut	3.7
Plum sauce	3.5
Flour foods ...	sometimes recognizable trace

Siedler (81) is quoted by Gheorghiu (82) as obtaining no trace of nickel in milk colored greenish blue from cooking in a nickel utensil. Siedler also prepared decoctions and infusions in nickel pharmaceutic utensils and found these preparations free from nickel. Gheorghiu, however, questions the accuracy of Siedler's method of testing for nickel.

Farnsteiner and his collaborators (83), investigating the resistance of nickel cooking utensils to chemical action, boiled 1 liter of 5 per cent. sodium

chloride solution for one hour in a nickel utensil and found at the end of this time only unweighable traces of nickel in the solution. When a mixture of 1 liter of 5 per cent. sodium chloride solution and 0.5 liter of 4 per cent. acetic acid solution was treated in the same way, 0.057 gm. to stand for periods varying from thre to eleven hours following the cooking The amount of fluid and the amount o nickel surface exposed were kept con stant (4 liters of fluid with an exposed surface of 1208.9 sq. cm.). An elec trolytic method of nickel analysis was

TABLE 3.—AMOUNTS OF NICKEL RECOVERED FROM VARIOUS FOODSTUFFS COOKED IN NICKEL UTENSILS (DZERZGOWSKY)

FOOD	CONTENT OF METALLIC NICKEL FOUND IN 500 GM. OF FOOD	ACIDITY
	mg.	*% acetic acid*
Water and tea	0.10	0.00
Potato soup	5.45	0.16
Gruel and soup	1.55	0.12
Cooked meat	1.10	0.13
Carrots	5.30	0.02
Sour sorrel	11.40	....
Sour cabbage soup	11.40	0.32

of nickel went into solution. Four hundred grams of material from a meal consisting of meat and cabbage cooked in nickel utensils showed only unweighable traces of nickel.

The feeding experiments of Dzerzgowsky and his associates (52) on animals in their effort to answer the question as to the injurious effect of the administration of nickel we have already detailed.[c] Experiments designed to answer the question concerning the maximum amount of nickel which will be taken up by various food materials rich in acids consisted in the cooking in nickel utensils of the following acids: 4, 2, 0.3, and 0.1 per cent. acetic, butyric, tartaric, lactic, and oxalic acids; and in the cooking of these same acids in the same percentages plus 5 per cent. sodium chloride. The test materials were cooked for three hours and were then allowed used. The following amounts of nickel per 100 c.c. of fluid were recovered from the various acid solutions:

Acid	*Nickel Recovered gm.*
Acetic	0.03218 - 0.00987
Butyric	0.01523 - 0.00845
Tartaric	0.02013 - 0.00591
Lactic	0.02536 - 0.00933
Oxalic	0.00810 - 0.01000

Similar recovery experiments were performed with various foodstuffs cooked in nickel utensils. The figures in Table 3 give the results of these food experiments.

According to Dzerzgowsky, the amount of nickel found in the foods cooked in nickel utensils varied between 0.32 and 0.02 per cent.

Lehmann (3), in 1909, in his "Hygienic Studies of Nickel," reports the results of cooking food in nickel utensils composed of 98 to 99.3 per cent.

[c] See pp. 320-321.

nickel, 0.2 to 0.3 per cent. copper, and 0.5 per cent. iron:

The food in each test was cooked for one hour and removed immediately from the utensil and placed in china dishes. The nickel utensil was washed out at once with water and wiped dry with a rubber sponge. During the cooking period, the quantity of water was kept constant.

In general, the nickel was weighed as an oxide. The results of the tests are given in the following tables (3, pp. 429, 430):

Nickel Analysis

		A mg.	*B* mg.
	I. Meats		
1.	(a) 250 gm. beef No. 1 quality, 5 gm. salt, and 250 gm. water	6.6	6.3
	(b) 250 gm. beef No. 2 quality, 5 gm. salt, and 250 gm. water	16.0	...
2.	250 gm. horseflesh, 5 gm. salt, and 250 gm. water	5.5	5.3
	II. Vegetables		
3.	250 gm. potatoes No. 1 grade, 5 gm. salt, and 250 gm. water	13.0	13.0
4.	250 gm. potatoes No. 2 grade, 5 gm. salt, and 250 gm. water	6.8	6.6
5.	250 gm. potatoes No. 3 grade, 5 gm. salt, and 250 gm. water	20.0	...
6.	150 gm. spinach and 350 gm. water	11.2	...
7.	250 gm. sauerkraut and 250 gm. water (No. 1)	28.8	28.8
8.	1,000 gm. sauerkraut and 550 gm. water (No. 2)	26.4	...
9.	750 gm. dried plums and 800 gm. water	19.9	...
10.	1,000 gm. (bought) huckleberries which had been boiled down to a very thick consistency and 500 gm. water	29.8	...
	III. Liquids		
11.	1 l. distilled water, 5 gm. salt, and 30 gm. beef extract	3.5	...
12.	1 l. tap water	4.6	...
13.	1 l. tap water and 5 gm. salt ..	5.3	...
14.	1 l. distilled water and 25 gm. neutral sodium phosphate	0.0	...
15.	1 l. 2% acetic acid	67.2	65.2
16.	1 l. milk	4.9	...

From these tables it will be seen that approximately nickel free and comparatively slightly acid foods absorb quantities of nickel which are almost insignificant.

Lehmann goes on to say:

It is a little difficult to arrange these figures in a series per kilo to which no objection could be made. It might, however, be done in the following way:

	Nickel Content mg.
1 kg. beef and 1 kg. broth	26.0 - 64.0
1 kg. potato soup (500 gm. potatoes and 500 gm. water) 23.6;	26.0 - 40.0
1 kg. spinach (300 gm. spinach and 700 gm. water)	22.4 ...
1 kg. preserved plums (500 gm. dried plums and 500 gm. water)	13.3 ...
1 kg. very concentrated huckleberries	29.8 ...
1 kg. sauerkraut (500 gm. sauerkraut and 500 gm. water)	17.6 - 57.0
1 kg. fruit (boiled down to 2% acetic acid)	65.1 - 67.2
1 kg. water, salt water, milk, or beef extract solution	3.5 - 5.3

Supposing that all the food eaten in a day by an adult was cooked in nickel utensils, the computed maximum amount of nickel absorbed would be about as follows:

1½ kg. beef and ¾ l. broth	up to 38 mg.
2 kg. potato soup	up to 40 mg.
½ kg. sauerkraut	up to 14 mg.
1 kg. jam	up to 15 mg.
	117 mg.[7]

It will be seen that a human being weighing 75 kilos may take as high as 117 mg. of nickel when all his meals are prepared in nickel utensils. In other words the human being would consume about 1.5 mg. of nickel per 1 kilo of weight.

These numbers may exceed those which are generally assumed. They are, however, obtained when using my maximum values as a foundation. The maximum values of Ernst Ludwig are, however, higher than mine and an absorption of 60 to 80 mg. of nickel during the exclusive use of nickel utensils might easily occur daily.

Lehmann himself actually proved this possibility by cooking a kilo of milk and a kilo of meat, respectively, in two vessels daily for 231 days, and by determining the losses of weight in the vessels which occurred during this period of cooking. In both cases the actual losses agreed remarkably well with the expected losses. The first vessel (containing milk) lost 1.418 gm. in weight,

[7]Column properly adds to 107 but individual figures given above and erroneous total of 117 are the figures actually reported by Lehmann. (Authors' note.)

and the second vessel (containing meat) lost 3.003 gm. as a result of the cooking alone, the cleaning losses having already been subtracted.

Lehmann concludes with the statement:

> Many foods when cooked in nickel utensils absorb only insignificant quantities of nickel while others absorb a larger amount. The absorption of nickel in these cases is similar to the absorption of copper from copper or brass utensils or of tin from tin cans.
>
> The quantity of nickel which can be absorbed by the exclusive use of nickel utensils is about 2 mg. per kilo of human being and is insignificant according to our tests.

Normann and Hugel (84), in 1913, using Tschugaeff's reagent as a method of determining nickel, found the following amounts of nickel per kilo of raw food used in foods cooked in nickel utensils:

	mg.
Stewed apples	46.40
White cabbage	83.13
Red cabbage	67.90
Sauerkraut	127.40
Kohlrabi	18.90
Baked potatoes	79.80
Coffee	0.03

Gheorghiu (82), in 1914, in a paper on "The Use of Nickel Ware in the Preparation of Food," reports the following experiments: (1) Two hundred grams of ordinary salt cucumber pickles and 150 gm. of meat with the required amount of water and salt were boiled in a nickel utensil for two hours and the resulting products (pickle, liquid, fat, and meat) were examined, by the use of Tschugaeff's reagent, for their nickel content. The following figures were obtained: pickles, 107.4 mg.; juice, 135.6 mg.; fat, 16.0 mg.; and meat, 0.0 mg. per kilogram of substance. (2) In preparing a second mixture, a Rumanian dish called "bors," consisting of bran and meat soup containing lactic acid, the author obtained 114.2 mg. of nickel per kilogram in the fluid part of the soup but nothing in the meat. The author concludes by saying that it is perfectly clear that food cooked in nickel pots will contain nickel, but the question as to whether or not the nickel present will be harmful to health he leaves to other investigators to determine.

Vuk (85), also working in 1914, found that various forms of nickel are dissolved by dilute acids with different degrees of facility. By heating separate portions of 700 c.c. of 5 per cent. acetic acid for two and one-half hours on a water bath, together with each of the different kinds of nickel tested—of which exactly 16,800 sq. mm. were exposed to the action of the acid—the following amounts of nickel, determined by an electrolytic method, were found to have been dissolved. The results are expressed in milligrams of nickel per square decimeter of surface:

	mg.
Rolled nickel	15.5 - 16.9
Cast nickel	25.5 - 28.8
Electrolytic nickel	30.6 - 30.8
Drawn nickel	33.1 - 39.0
"Berndorf rein" nickel	61.4 - 65.4

Vuk believes that these findings may aid in explaining the conflicting opinions of various investigators as to the harmfulness or harmlessness of nickel utensils.

Hale and Foster (86), in 1915, studied the corrosive action of dilute (N/5) acids, alkalies, and salts on commercial, cold, hard-rolled samples of eight different metals, including nickel. Cleaned, polished pieces of metal 1 sq. dm. in size were immersed (*a*) for seven days in ½ liter of solution which was changed daily; (*b*) for twenty-eight days in ½ liter of solution which was not renewed; and (*c*) for four hours in 1 liter of N/5 acid. The weight loss per square decimeter was then determined. The solvents tested were dilute solutions of ni-

tric acid, hydrochloric acid, sulphuric acid, magnesium chloride, sodium hydroxide, calcium chloride, sodium chloride, ammonium hydroxide, and sodium carbonate. The amounts of nickel lost in grams varied between no loss in sodium chloride, sodium hydroxide, ammonium hydroxide, and sodium carbonate solutions in twenty-eight days and 4.2 gm. in seven days in the nitric acid solution. No loss in any solution other than nitric acid exceeded 0.45 gm. in twenty-eight days (hydrochloric acid). All tests were conducted at 17° to 20° C.

Heath (87), in 1917, interested in substitutes for platinum ware, conducted tests upon various metals—among them nickel—on the effects of heat and of hydrochloric, sulphuric, and nitric acids on the test substances. Among other figures obtained are the following. A nickel crucible heated to a high temperature for as long as thirty-two hours lost 0.001 gm. in weight. Another crucible of wrought nickel, subjected to the action of hydrochloric acid (sp. gr., 1.2) for thirty minutes at 18.5°C., lost 0.124 gm. in weight. A spun nickel crucible, subjected to the action of sulphuric acid (sp. gr., 1.84) for thirty minutes at 18.5° C., lost 0.059 gm. in weight. The author concludes that nickel may take the place of platinum in electrolytic analysis and in other preparations where strong acids are absent, but is not desirable for strong alkaline fusions.

Bordas (9), in 1919, investigating the suitability of various hydrogenated oils for human consumption and the possible toxicity of a small amount of nickel contained therein, boiled the following liquids in a nickel utensil for half an hour, and then analyzed the liquid for nickel with the following results:

Liquid	*Nickel Content*
	mg.
Ordinary water	none
Distilled water	.....
2% alkali solution	traces
2% acetic acid solution	10
5% oxalic acid solution	15
7% sodium chloride solution ...	none
Oleic acid heated for 5 minutes after the commencement of decomposition	50

Järvinen (88), in 1923, tested the solubility of the metals of cooking vessels in a 40 per cent. sugar solution containing 1.5 per cent. of citric acid and in a 5 per cent. salt solution. The acid solution had approximately the same effect on the vessels as an extract of currants containing 40 per cent. of sugar and 1.29 per cent. of acid, as citric acid. The following average results were obtained after three hours' boiling of the two solutions, respectively, in vessels of the metals named, expressed as milligrams of metal dissolved per kilogram of solution: iron, 1400, 104; untinned copper, 65, 70; tinned copper, 27, 7; nickel, 76, 4; aluminium, 120, 9; brass, 0.5, 1.2 (Cu), 2.1, 20 (Zn); enamel, 6000, 0.

Donauer (89), studying the action of metals on milk, carried out a series of tests on fifteen metals and metal alloys in which a definite area of the test metal was exposed at both warm and cold temperatures (*a*) to 0.2 per cent. lactic acid solution, (*b*) to sweet milk containing 0.2 per cent. acid, and (*c*) to sour milk containing 0.26 per cent. acid. In some tests the action was allowed to continue twenty-four hours; in others, over four weeks. All results were calculated on a twenty-four-hour basis. Among other figures the following were obtained: Nickel vats at pasteurizing temperatures contaminate sweet milk with 0.07 mg. of metal per square centimeter of surface exposed per day; or, expressed in other terms, 500 gallons of sweet milk during the pasteurizing process absorb from nickel vats 1/50 ounce of nickel. Under the same circumstances but with

vats made of aluminium, copper, or tin, the milk will absorb 1/20 ounce of aluminium, 1/50 ounce of copper, and 1/40 ounce of tin. These figures are much higher with ripened milk, sour cream, and other milk products having higher acidity and especially where the emulsion is coagulated. At normal temperatures, the amounts of metal taken up by sweet milk are about one-tenth as great as during pasteurizing operations.

In the order of their resistance to 0.2 per cent. lactic acid, a list of the metals would run as follows: (1) silver, (2) German silver, (3) brass, (4) bronze, (5) monel metal, (6) copper, (7) nickel, (8) steel alloy II, (9) white metal alloy, (10) tin, (11) nickel-iron alloy, (12) aluminium-bronze alloy, (13) steel alloy I, (14) aluminium, (15) steel alloy III, (16) iron, (17) zinc.

Nickel lactate is readily soluble in water and can be detected very easily, even in very dilute solutions, by its astringent puckery metallic taste. This taste may be imparted to milk if it stays long enough in a nickel container; 14.25 parts per million of nickel lactate in water can be definitely tasted. Metal lactates, added to milk, combine with the casein and, if added in large enough amounts, curdle the milk. The products formed are metallic caseinogenates, and these substances, through their tendency to separate out, may form exceptionally hard curd on the walls of an evaporated milk can during the sterilizing process. The greater portion of a metallic compound may be concentrated through absorption by the fat in milk and may become noticeable only after butter has been made. Comparative experiments seem to point out that metallic compounds in milk or butter, in much smaller amounts than can ordinarily be detected, may cause putrefactive decomposition or hasten the appearance of rancid flavors through catalytic or selective enzyme action. A considerable proportion of the vitamines in milk products may be destroyed by metals. (This fact, according to Donauer, is one demonstrated by Hess (90) for copper. See also Ellis and Macleod (91).)

Further studies on the influence of metals and metallic salts on milk are listed under bibliographic reference (92).

Donauer (89), in a second article on the action of metals on fruit and vegetable products, reports experiments showing the relative amounts of fourteen different metals and metal alloys absorbed by hot and by cold citric, malic, and tartaric acid solutions of strengths such as are commonly found in fruits, together with experiments on metal absorption by hot and by cold grapefruit juice, grape juice, and tomato pulp. The following figures for nickel are illustrative of those obtained: The amount of nickel absorbed per sixty-hour week from a 100-gallon kettle when used for cooking tomato pulp was 0.09 ounce; for pasteurizing grape juice, 0.05 ounce; for concentrating apple juice, 0.09 ounce; for cooking sauerkraut, 0.045 ounce; for pasteurizing grapefruit juice, 0.2 ounce.

Donauer comments on the fact that the metal salts formed under these circumstances have very strong metallic flavors and that 5 to 10 parts per million will usually impart a definite metallic taste. In many cases, a food may, in addition to absorbing foreign flavors, be affected in other ways when being processed in metal equipment. Citrous fruit juices are darkened by most metals except silver, aluminium, and some aluminium alloys. Concord grape juice is changed considerably in color by copper and its alloys and by nickel. Nickel and iron tend to change the bright red

color of tomato products to a brown.

Donauer concludes by saying:

> Just how far reaching the effects of the presence of small amounts of the more active metals may be on the food is difficult to determine, but from the general tendencies which have been noted it is quite logical to assume that the life of the food in the package may be affected considerably by their action. At any rate, the information which is available is sufficient to assure the food products manufacturer that any steps taken to avoid absorption of metal in the processing of his foods will be well worth the efforts expended.

ii. Observations on the Results of Eating Food Stored or Cooked in Nickel Utensils.—Rohde (51), writing in 1889, says that he and his wife used nickel utensils constantly for five years and that, among other things, the utensils were used in the preserving of fruits of all sorts whether bought in small quantities for daily, immediate consumption or in large quantities for winter use. During this time, neither Rohde nor his wife experienced any disturbance of health which suggested symptoms of acute or chronic nickel poisoning.

Garnier (79), in 1890, investigating the possible utility of "white bronze of nickel" (copper, 75 per cent.; nickel, 25 per cent.) for cooking utensils, reports the appearance, in all foods cooked in a utensil of this metal, of a disagreeable, characteristic metallic flavor. Violent vomiting followed the ingestion of onion soup which had been cooked in and had stood hot for four hours in the vessel in question. This soup had a greenish discoloration due to the corrosion of the metal by the oxalic acid of the onion and the lactic acid of the milk. Garnier expressed the opinion that utensils made of this metal would not be practicable.

Ludwig (80), in 1898, reports that for two and one-half years his entire family and also his servants, eleven and sometimes twelve people in all, ranging in age from 6 to 56 years, daily ate and drank food prepared only in nickel utensils. The urine of persons who had eaten such food never gave an indubitable reaction. Ludwig, during the period of observation, never observed any hygienic disturbances attributable to nickel. This author also cites two families of his acquaintance who used nickel cooking utensils for a long time with favorable results only.

Farnsteiner and his associates (83), in 1904, in a paper on the corrodibility of nickel utensils say that "after eating food cooked in nickel utensils illness sometimes appears."

Faichnie and Langrishe (93), in 1910, reported the following instance of what they believed to be nickel poisoning from drinking barley water. Barley water, flavored with the juice of fresh limes and put in a large metal urn having a central chamber for ice, was drunk by four officers at lunch and by a mess sergeant in the evening. Within fifteen minutes the soldier (the barley water had stood all day) felt very ill. The officers did not actually vomit but the desire to do so lasted all day; the sergeant vomited. On analysis, the barley water showed the presence of nickel. The urn was made of some white metal coated with nickel. Ration lime juice contains 6 per cent. citric acid, and in the opinion of the authors this acid, by dissolving the metal of the urn, was the cause of the trouble.

Offerdahl (7), in 1913, took 0.5 gm. of metallic nickel powder mixed with whale fat every day for a month without objectionable results. Determinations of nickel in his urine and feces accounted for 98 per cent. of the nickel eaten.

Normann and Hugel (84), in 1913, cite a family (the family of one of the

authors?) whose food was cooked for a long time in nickel utensils without any ill effects being experienced.

iii. Opinions of Various Investigators in Regard to the Effect upon Health of Eating Food Cooked in Nickel Utensils.—Geerkens (13), in 1883, basing his opinion on researches of his own on the corrosion of nickel vessels and on the feeding of nickel salts to animals, concludes that:

> The household use of nickel utensils is without danger since the small amounts of nickel that go into solution, even under the most favorable circumstances, are not sufficient to be poisonous.

Birnbaum (77), 1883, begins his paper on the resistance of nickel-plated cooking utensils to organic acids by saying that utensils of this type have recently made their appearance on the market, and that it seems probable that they will gain entrance to the kitchen and be used in the preparation of all kinds of foods, partly because of their good appearance and partly because of the fact that an abstract of the paper which H. Schulz delivered at a meeting of the Lower Rhine Society for the Sciences of Nature and Public Health accompanies printed instructions included with every sale. After reporting experiments of his own on the corrosion of nickel pots by organic acids and after discussing Schulz's experiment[8] in which a dog was fed a total of 10.5 gm. of nickel acetate during three weeks without harmful effect, Birnbaum concludes as follows:

> Schulz has up to now only experimented on one dog. Whether other animals, especially human beings, react in a similarly indifferent way to nickel salts has yet to be decided. . . . . Schulz does not mention whether the nickel compounds pass rapidly through the body or are stored up somewhere in the organism. . . . . Before these physiologic questions are properly answered great care should be taken when using nickel plated sheet iron utensils and they should not be used for the preparation of acid foods.

Schulz (94) himself, also writing in 1883, favors the use of nickel utensils and answers Birnbaum's objection to their use for acid foods by saying:

> As far as I know, cooks prefer to use for the cooking of sour fruits, cucumbers, and the like, not metallic vessels, but earthen or enameled ones. There is no reason why other utensils than nickeled ones should not be used in doubtful cases.

Basing his ideas upon experiments of his own and those of other investigators, van Hamel Roos (50), writing in 1887, expresses the opinion that:

> The absolute prohibition of the use of nickel utensils is not sufficiently justified, at least from a consideration of the physiologic effect of the acetate (the most frequent form of nickel occurring in the domestic economy).

Speaking later at the Sixth International Congress for Hygiene and Demography, held in Vienna in 1887, Roos commented on the fact that since the Superior Council of Hygiene in Austria had forbidden the employment of nickel utensils and since there was no official prohibition in this respect in other countries, a great embarrassment resulting from these opposed opinions existed for industry and commerce. Roos then went on to present experimental evidence of his own and of others on the feeding of nickel acetate to dogs without harmful effects. As a result of Roos's presentation and the discussion which followed, the Congress passed a resolution to the effect that "the absolute prohibition of the household use of nickel or of nickel-plated utensils has not sufficient foundation."

[8] See p. 317.

Riche (35), in 1888, after reporting numerous experiments of his own on the feeding of nickel salts to animals, writes:

> In my opinion the ingestion of a salt of nickel does not present any more danger to the guinea-pig or the dog than a salt of iron. One cannot obviously affirm with these results, that a man will absorb without inconvenience a corresponding daily dose of nickel, but when one has read the numbers that I shall publish shortly on the quantities of nickel dissolved by the different liquids one will be forced, I think, to conclude that vessels of nickel can be used without danger to hold and to prepare food materials.

After further experiments in which nickel salts were injected hypodermically or intravenously into animals, Laborde and Riche (35), writing together, express the opinion that "nickel, in its useful applications, notably in pharmaceutic and food utensils, can and ought to be considered as without any danger to health." In a second paper, these same authors write as follows:

> Taking the results [of our experiments] as a whole, one can, I believe, be convinced that nickel dissolves very slowly and very feebly in the alimentary liquids and, when one considers the strong dose which animals can take for entire months without inconvenience, one is led to conclude that metallic nickel may be used without fear in the manufacture of vessels destined to heat or to contain foods or neutral or alkaline pharmaceutic liquids.

Basing his ideas on experiments of his own on the corrosion of nickel utensils, on the results of feeding experiments, on the opinions of other investigators, and on the personal household use of nickel utensils for five years, Rohde (51), 1889, expresses his own opinion that nickel utensils are harmless, assuming that they are made in a reputable factory. He adds the suggestion that manufacturers of nickel utensils accompany their ware with short instructions as to its use—as, for example, the undesirability of storing food in nickel containers.

Garnier (79), in 1890, having been made violently ill from eating food cooked in a pot made of white bronze of nickel (copper, 75 per cent.; nickel, 25 per cent.) expresses the opinion that utensils made of this alloy would not be practicable.

Gheorghiu (82) refers to two papers by Vogel (95), published in 1895, the first of which contains a report of the adverse criticism of the chef of the Westminster Hotel in Berlin on nickel utensils, on the ground that food cooked in nickel ware becomes more or less discolored or else tastes. In the second paper this criticism is somewhat limited.

After his family of eleven to twelve persons had used nickel cooking utensils exclusively for two and one-half years without any disturbance of health —a period during which he had repeatedly analyzed samples of food and drink for nickel—Ludwig (80), in 1898, wrote as follows:

> My experience agrees fully with that of Rohde who says that he has used nickel cooking utensils constantly in his household for five years, especially for preserving fruits of all sorts, and that during this long period neither he nor his wife have had a single disturbance of health.
>
> The recent repeal of the law according to which the use of cooking utensils of technically pure nickel is unhesitatingly allowed is entirely right, and the particular qualities of this metal will now become more appreciated through the increase of the household use of nickel utensils.

In the course of his paper, Ludwig speaks of the favorable experiences which a family living near him had had during a year's use of nickel-plated vessels for the preparation of food, and then refers to the fact that his colleague, Herr Professor Dr. Fl. Kratschmer, had shortly before testified before a

Vienna magistrate as to his good opinion of nickel cooking utensils.

Vuk (85) quotes Erdmann (96), who wrote in 1900, as saying:

> It is not advisable to make cooking utensils, spoons, and eating implements out of nickel or its alloys as is often done, since in cooking salty and acetic acid containing foods in such utensils nickel goes into solution in weighable amounts and the nickel salts cause unpleasant symptoms of poisoning.

Basing their conclusions on studies of the amount of nickel corroded from nickel utensils by various acids and foods cooked in them and on an extensive series of animal feeding experiments, Dzerzgowsky and his associates (52), 1906, expresses the opinion that:

> The small doses [of nickel] found in food prepared in nickel cooking utensils cause no intestinal irritation, are not absorbed, therefore do not reach the organism and cannot be harmful.

Lehmann (3), in 1909, discussing the advantages of nickel cooking utensils, says that the high melting point (1500°) of nickel gives a distinct advantage to utensils made of this metal as compared with others. A very hot gas flame will not injure an empty nickel utensil while the galvanized surface of a galvanized utensil swells and the enamel of an enameled utensil cracks if suddenly cooled. Even aluminium starts to swell at a temperature of about 600°.

Nickel is much harder than tin or aluminium and is almost as hard as soft iron. Nickel utensils of the usual thickness of 1 mm. have, therefore, an extraordinary capacity for resistance to rough impacts.

Lehmann's paper concludes with the following statements:

> 2. Various foods when cooked in nickel utensils absorb only insignificant quantities of nickel while others absorb a larger amount. The absorption of nickel in these cases is similar to the absorption of copper from copper or brass utensils or of tin from tin cans.
>
> 3. The quantity of nickel which can be absorbed by the exclusive use of nickel utensils—about 2 mg. per kilo of human being—is insignificant according to animal investigations.
>
> 4. I, at least, have not observed any disturbance of health, which may be traced to nickel, by the absorption of 6 to 10 mg. per kilo of cat or dog in the course of 100 to 200 days. . . . .
>
> 5. Nickel introduced into the body in small quantities as a non-corrosive compound with the food does not exert any injurious effect as is the case with copper, zinc, and tin, which I may say we consume in far greater amount than we generally suppose.

Formenti (97), in 1911, in an article entitled "The Occurrence of Poisonous Metals in Foods," discusses briefly all the heavy metals that are utilized for cooking utensils or for household use. Of nickel he says:

> This metal must be included among those in practical use because it is now obtained on a large scale by the Mond process and cooking utensils made from it are already in use. The toxicologic properties of nickel have not been closely investigated and the last word has not yet been said. The cooking of acid foodstuffs in nickel utensils should be avoided and other classes of foods should not be permitted to remain in contact with the metal for too long a period of time. . . . .
>
> No law regarding the use of nickel utensils exists in Milan.

Kolipinski (74), writing in 1911 on the uses of nickel sulphate in medicine, says:

> All experimenters agree that acute or chronic poisoning does not result from the use of nickel implements, instruments, and vessels used in the arts or in domestic cooking.

It is Gheorghiu's (82) opinion that food cooked in nickel utensils will cer-

tainly contain nickel but he prefers to leave it to other investigators to determine whether or not the amount of nickel present will be harmful to health.

Ellis (8), 1914, in his book on "The Hydrogenation of Oils," writes:

> Nickel-lined ware has been in use for ten years or more and during this period many people have eaten foodstuffs containing nickel, without any injurious effects being noted.

Sollmann (98), 1917, writes in his "Manual of Pharmacology:"

> Nickel cooking utensils give up a harmless trace of the metal to the food.

"The Dispensatory of the United States of America," twentieth edition (99), says:

> Large doses of *nickel* seem, however, to be necessary for a toxic influence, and the use of nickel in culinary instruments appears to be entirely safe.

Cushny (53), 1918, in his "Text-Book of Pharmacology" writes as follows:

Strongly acid food may form nickel salts when it is cooked in vessels made of this metal, but no poisoning results, either because the quantity ingested is too small or because it is too slowly absorbed from the stomach and intestine.

The following quotation is taken from a letter of A. R. Cushny, which is given by W. D. Halliburton (100) as an addendum to Part II of a report of a committee of the Royal Society on "Fats and Fatty Acids as Food:"

> Minute traces of nickel in hydrogenated fats are not injurious to health. Nickel is among the most harmless of metals and I am unaware of any case of poisoning having occurred from it, although several investigators have taken considerable quantities of it in food often over prolonged periods. It is difficult, therefore, to name a definite figure as a limit, but it may be suggested that if the fat should be found to contain more than 10 parts per million, careful observations should be made. My own impression is that fat containing very large amounts of nickel would have an unpleasant metallic taste, and that this would prevent the use of any fat containing an injurious amount of nickel.

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(a). Decree passed in Austria, Feb. 26, 1886, declaring nickel dangerous and forbidding its use for the preparation of food materials. In the law it is stated that compounds of nickel are injurious to health and that their introduction into the organism must be carefully avoided. Referred to by Riche (35)

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and by Rohde (51).
Van Hamel Roos (50), at the Sixth International Congress for Hygiene and Demography held in Vienna in 1887, referred in protest to the prohibition of the use of nickel cooking utensils by the Austrian Superior Council of Hygiene. A resolution was passed at this Congress that the "absolute prohibition of the household use of nickel or of nickel-plated vessels has not sufficient foundation."
(b). Industrie-Blätter, 1886, *96*, 120, contains a warning from the Wiener Sanitätsbehorde against the use of nickel cooking utensils. Quoted by Vuk (85).

76. Repeal of Austrian law against the use of nickel cooking utensils and favorable health notice in regard to their use:
(a). (Austria.) Verordnung der Ministerien des Innern, der Justiz und des Handels vom 13, October, 1897, R. G. Bl. Nr. 235, womit Bestimmungen über die Erzeugung oder Zurichtung von Ess- und Trinkgeschirren, dann Geschirren und Geräthen, die zur Aufbewahrung von Lebensmitteln oder zur Verwendung bei denselben bestimmt sind, sowie über den Verkehr mit denselben erlassen werden. Text of decree given in Ztschr. f. Nahrungsmittel-Untersuchung, Hygiene und Waarenkunde, 1897, *11*, No. 20, pp. 342, 343. This law permits the unhesitating use in Austria of nickel cooking utensils. "Kochgeschirre aus technisch reinem Nickel dürfen anstandslos verwendet werden."
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Section 2

The Detection and Estimation of Minute Amounts of Nickel in Biologic Material

I. Introduction

The usual methods for the determination of nickel, preceding Tschugaeff's (1) discovery of di-methyl-glyoxime as a reagent for nickel in 1905, were not very satisfactory when applied to minute amounts. Physiologic experiments had the further disadvantage that the material for analysis—tissues, excreta, etc.—contained inorganic substances from which it was difficult to separate nickel quantitatively. For instance, Lehmann (2), who appears to have done very careful experimental work of this nature, found it necessary to re-precipitate the nickel several times in order to make sure of recovering it quantitatively in such a manner as to be free from impurities. The disadvantages that one encounters in analyzing for minute amounts of a metal such as nickel in biologic material are more apparent when one considers the factors involved. In the first place, one is exploring a region where the solubility relationships are different from those encountered in grosser analytic work. Thus, the determination of silver as chloride may be made very exactly when dealing with tenths of a gram of material. With tenths of a milligram the situation is quite different, for silver chloride is soluble to the extent of 1.5 mg. per liter of water and, while the figure is reduced by the presence of an excess of common ion, the proportionate loss is greater than with larger amounts of silver. The other factor of importance is that the amount of other salts present from which it is necessary to separate a metal is often relatively enormous. The ash from a quart of cow's milk averages 7 gm. In this amount of ash it may be necessary to estimate a few hundredths of a milligram of nickel.

Although attempts were made in this work to apply other methods (such as an electrolytic method) to the estimation of a small amount of nickel in the presence of a large excess of ash, more attention was devoted to the di-methyl-glyoxime and the α-benzyl-dioxime methods. These have the advantage of affording a clean separation of nickel, and the disadvantage of precipitating calcium, magnesium, phosphates, and iron under the conditions necessary for the precipitation of the nickel oxime. It is futile to attempt to precipitate the nickel as sulphide in alkaline solution, re-acidify, and separate the nickel sulphide which has now been converted into a form usually assumed to be insoluble in hydrochloric acid. This method has been used by some as a means of separating nickel from the ash of biologic material. Contrary to the general impression, nickel sulphide precipitated in alkaline solution is slightly soluble when carried into dilute acid. If the oxime method is employed, some

means of removing the other substances without affecting the nickel must be used, since removal of the nickel first is impracticable.

It was found that by the addition of sodium citrate iron could be maintained in solution, and that calcium could be precipitated as oxalate and magnesium as ammonium magnesium phosphate and still permit a good recovery of nickel. It is possible so to regulate the precipitation that first the calcium is precipitated as crystalline calcium oxalate, and then the magnesium as crystalline ammonium magnesium phosphate, one filtration serving to remove both. Nickel may then be precipitated from the ammoniacal solution by the addition of dimethyl-glyoxime or α-benzyl-dioxime, preferably the latter.

While this gives a more quantitative separation of nickel than the older methods, it is necessary to dissolve the precipitates of calcium oxalate and ammonium magnesium phosphate and re-precipitate them in order to recover the part of the nickel that is mechanically carried down with the first precipitate. This may amount to 25 per cent. of the total amount of nickel present. The difficulty, however, is not in recovering this nickel —since this is easily effected—but in estimating the amount of nickel after it has been separated. Where the nickel precipitate weighs several milligrams, it may, of course, be dried and weighed, but where the precipitate amounts to 1 mg. or less, weighing with accuracy is out of the question as a matter of routine procedure.

A colorimetric method of estimating small amounts of nickel, based on the di-methyl-glyoxime reaction, was developed by Armit and Harden (3) in 1906. Measured amounts of nickel solution are treated with 0.5 c.c. of 10 per cent. ammonium hydroxide and the same amount of alcoholic di-methyl-glyoxime solution, diluting finally to 30 c.c. The colored solution is matched against various standard colored solutions similarly prepared and containing known amounts of nickel. Armit claims an accuracy of 0.7 per cent. in the determination of 0.07 mg. of nickel. He gives, however, but little data in support of this.

An attempt to apply the procedure recommended by Armit was not encouraging. While small quantities of nickel can be detected by this means, their estimation was far from being satisfactory. It is very difficult to match the colors satisfactorily, and this difficulty was finally traced to the form in which the oxime exists. In dilute solution, there is a definite reaction interval after the addition of the reagents before the pink tint of the nickel oxime is apparent. The pink "tint" which appears is due to reflected light from the nickel oxime, which exists as a definite solid crystalline phase. There is no solution of this salt, as the filtrate is colorless, while the crystals are collected on the filter paper. It is, therefore, a turbidimetric, not a colorimetric method. The chief difficulty found was the uncertainty of the test for low dilutions (hundredths of a milligram). It was impossible to secure satisfactory checks when using known amounts of nickel and various salt concentrations in order to duplicate actual analytic conditions. This is not surprising in view of the fact that the test depends on the separation of a solid, minute in amount, and hence very sensitive to salt concentration. At first, the nickel oxime is very highly dispersed, the particles becoming larger and larger, depending on the amount of nickel, the length of time the solution stands, and the concentration of other

salts present. As is well known, salts of various metals have the property of precipitating colloids at rates dependent on the valences of the metals and on the salt concentration. These salts, therefore, have the property of decreasing the dispersion of the nickel oxime. It is not surprising that variable results are secured, since the success of the test must, in consequence, depend on uniformity of particle size.

A colorimetric method is practically the only one which may be used with accuracy and convenience for the analysis of very minute amounts of material. A color test that has been used for nickel for years is the thiocarbonate reaction. Potassium thiocarbonate develops a color with nickel salts varying in tint from brown-red to carmine-red. Thiel and Ohl (4) found its limit of sensitivity to be 0.01 mg. of nickel, and investigation soon proved it to be unsatisfactory as a reagent in this present work—particularly since development of the color in alkaline solution is necessary.

In 1909, Jones and Tasker (5), in the course of an investigation of the di-thio-oxalates, found that potassium di-thio-oxalate developed intense colors with a number of metallic salts, among them nickel. They found that nickel di-thio-oxalate forms black crystals which color water more intensely than potassium permanganate.

Ethyl di-thio-oxalate was synthesized and the potassium salt prepared according to the method of Jones and Tasker. The salt was soon found to have two very valuable assets as a reagent for nickel: (*a*) The color is permanent for several hours, and (*b*) the color develops and is permanent in acid solution. This latter is a very valuable feature, since it obviates the necessity of removing calcium, magnesium, or phosphates —none of which interfere with the color. Iron in small amounts gives an intense purple color and must be removed. Cobalt gives a yellowish or brownish color and, although it does not apparently interfere when present in minute amounts, where it occurs in such amount as to be noticeable in the colorimetric test for nickel the alternate procedure outlined later in this report must be adopted. Manganese barely develops a visible color when present to the extent of 15 mg. in 50 c.c. of solution and viewed through a Nessler tube. It is, therefore, not a factor in the analysis of biologic material for nickel. The two procedures for the estimation of nickel are described below.

II. The Method of Analysis

1. Drying and Carbonizing

The material (tissues, excreta, foodstuffs, milk, etc.) must be dried, baked in an oven until charred, and then ashed, preferably in an electric muffle furnace. Transfer the material to a porcelain dish and heat to dryness on a hot plate or in an oven. When dry, increase the temperature so that the material is carbonized. Transfer the char to a small porcelain dish for ashing. Urine or milk should be boiled to dryness in a large porcelain dish on a hot plate. Vigorous boiling is to be avoided, and, in order to prevent bumping and spattering, add 10 c.c. of concentrated hydrochloric acid. Char the residue as above and transfer to a small porcelain dish.

2. Ashing

Transfer the dishes of carbonized material to the muffle furnace and begin heating at a low heat, finally running the temperature up to a full red heat. They should remain at this temperature no longer than half an hour as the salts (in

the case of urine and certain foodstuffs) fuse and coat the carbon particles, preventing any further oxidation and making the subsequent extraction difficult. It is better to underheat the first time than to overheat. After the dishes have been removed and are cold, treat them with 15 c.c. of 1.1 hydrochloric acid, cover the residue with water, and heat to boiling, first covering the porcelain dishes with clock glasses. Filter and extract twice more with boiling water. Return the filter paper and residue to the porcelain dish, dry in a hot-air oven, and re-ash in the muffle furnace. When cold, extract as before. One more ignition and extraction will generally be necessary before everything goes into solution. There is usually a silicious residue from feces which may be discarded.

3. *Removal of Heavy Metals*

Neutralize the hydrochloric acid solution with 25 per cent. sodium hydroxide, using methyl orange as an indicator. Then add a few drops of hydrochloric acid until the solution is just acid in reaction. Saturate the cold solution with hydrogen sulphide gas and allow it to stand a few hours or overnight if no precipitate forms at once. Filter and wash the residue with hydrogen sulphide water. Boil the filtrate until free from hydrogen sulphide and add bromine water in sufficient amount to oxidize the iron to the ferric state. The solution is then analyzed for nickel by one of the two following methods.

4. *Estimation of Nickel*

A. In the Absence of Cobalt

It is necessary to free the solution from iron only in order to estimate the nickel directly. Most biologic material contains iron in varying amounts, accompanied usually by a greater amount of phosphate. Ferric phosphate is insoluble in neutral or acetic acid solution, and the iron may be removed, therefore, by merely neutralizing the solution. This must be done carefully, however, in order to avoid precipitating calcium and magnesium phosphates. The best plan is to add a buffer salt such as ammonium acetate. The slightly acid solution containing ferric iron should be treated with 10 c.c. of 50 per cent. ammonium acetate solution and 5 c.c. of glacial acetic acid. All the free hydrochloric acid is neutralized by the ammonium acetate, and an equivalent amount of acetic acid is liberated. The acetic acid prevents the precipitation of calcium and magnesium phosphates. The solution *must be cold* before the ammonium acetate is added, otherwise part of the iron will be reduced and thus escape precipitation. Filter the cold solution through quantitative filter paper into a volumetric flask. The filtrate should be water-white with no trace of turbidity. The ferric phosphate is usually small in amount and is readily filtered out. Dilute the solution to an exactly known volume, say 500 c.c.

Nickel Reading.—Transfer 50 c.c. of this solution to a Nessler tube and add a small amount of potassium di-thio-oxalate. If nickel is present, a clear magenta color develops at once. If nickel is absent, no color is apparent except that the solution may be slightly yellowish from using too much di-thio-oxalate. A brownish color indicates an excess of cobalt in the solution; a purple shade shows that the iron has not been completely removed, and in this event it will be necessary to repeat the oxidation and precipitation with an aliquot part of the solution. This is very troublesome and it is far easier to insure complete oxidation of the iron at the earlier stage.

In order to determine the amount of nickel present, a series of nickel standards in Nessler tubes may be prepared, ranging from 0.005 to 0.05 mg. of nickel —*i.e.*, 0.005, 0.01, 0.02, 0.03, 0.04, 0.05 mg. The unknown solution may then be matched against these. It is not advisable to use higher concentrations of the standard nickel solution, as the tint is too deep for satisfactory reading. For larger amounts of nickel, it is preferable to use a colorimeter of the Duboscq type.

B. In the Presence of Cobalt

In case cobalt is present in amount sufficient to interfere with the colorimetric test for nickel, separation of the nickel from the cobalt will be necessary before the test is applied. Iron, if present in the solution, may be prevented from precipitating at a later stage (as the hydroxide) by the addition at this point of sodium citrate. Add 10 c.c. of 20 per cent. sodium citrate solution. Then add ammonium oxalate solution very slowly, stirring constantly, so as to separate calcium oxalate in crystalline form in the acid solution. When precipitation ceases, add dilute ammonium hydroxide slowly in such a manner as to produce crystalline ammonium magnesium phosphate in the same solution without filtering out the calcium oxalate. After the calcium and magnesium are quantitatively precipitated, they should be filtered out, washed, re-dissolved in hydrochloric acid, and re-precipitated as before. The filtrate from this precipitation should be combined with the first filtrate. In this way any nickel that is mechanically carried down with or incompletely washed out of the first precipitate may be recovered. The alkaline filtrate, which is now free from calcium, magnesium, and phosphates (although the latter are removed only as a means of eliminating magnesium), is treated with an excess of α-benzyl-dioxime, filtered, the residue dissolved in acid—aqua regia is preferable—and the acid solution evaporated to dryness in a porcelain dish. Add 1 or 2 c.c. of concentrated hydrochloric acid and again evaporate to dryness in order to destroy any excess of nitric acid. Finally, dissolve the residue in a few drops of dilute hydrochloric acid, dilute to a convenient known volume, and determine the nickel content by the colorimetric method already outlined.

The second method is longer and more troublesome than the first, and fortunately need be utilized only in those cases where a noticeable amount of cobalt is present. The small amount of cobalt existing in nickel or nickel salts is insufficient to have any effect on the color obtained and, judging from the analyses obtained thus far, it is only occasionally that cobalt is excreted in sufficient amount to interfere with the test.

III. Experimental Verification of Method

Experiments carried out with the methods outlined have been very satisfactory. The second method, while more tedious than the first, gives good results provided sufficient care is taken to guard against losses. Since the second method, however, requires careful manipulative technic at every step, it is fortunate that the first method serves most purposes. The following figures represent recoveries of nickel added to flour, which was then ashed and the nickel determined after one precipitation of calcium and magnesium:

One Precipitation of Calcium and Magnesium

Number of Experiment	*Nickel Added mg.*	*Nickel Recovered mg.*
1	0.99	0.73
2	0.99	0.64
3	0.99	0.69
4	0.99	0.73

A little less than 75 per cent. of the nickel was recovered by this procedure. A second series in which the calcium and magnesium salts were dissolved and re-precipitated shows improvement:

Calcium and Magnesium Re-Precipitated

Number of Experiment	*Nickel Added mg.*	*Nickel Recovered mg.*
1	0.99	0.89
2	0.99	0.94
3	0.99	0.90
4	0.99	0.92

While the recoveries in the second case are good, they do not correspond with the sensitiveness and delicacy of the colorimetric test itself. The color is so intense that it is possible to distinguish between values of less than 0.01 mg. with very little practice. The preceding experiments were repeated using 10 gm. of flour as the base from which to recover nickel. The flour itself was analyzed for nickel and none was found in the 10 gm. samples used as checks. In all the following experiments the first method was employed:

Recovery of Nickel Added to Foodstuffs (Flour)

Number of Experiment	*Nickel Added mg.*	*Nickel Recovered mg.*
1	0.10	0.11
2	0.10	0.10
3	0.10	0.11
4	0.10	0.10
5	0.10	0.08
6	0.10	0.09

Recovery of Nickel Added to Foodstuffs (500 c.c. Milk)

Number of Experiment	*Nickel Added mg.*	*Nickel Recovered mg.*
1	2.00	1.92
2	2.00	2.00
3	2.00	1.75
4	2.00	1.93
5	Blank	None

Recovery of Nickel Added to Ash Equivalent to 500 c.c. Milk

Number of Experiment	*Nickel Added mg.*	*Nickel Recovered mg.*
1	1.00	0.99
2	1.00	0.98
3	1.00	0.99
4	1.00	1.01
5	1.00	0.98
6	1.00	1.01
7	1.00	1.00
8	1.00	0.96
9	1.00	0.99
10	1.00	0.98

In the last table, results are given for the estimation of nickel added to ash made up in imitation of the ash of milk as given by Hammarsten. According to these analyses, 1,000 parts of the milk contain:

	gm.
K_2O	0.780
Na_2O	0.232
CaO	0.328
MgO	0.064
Fe_2O_3	0.004
P_2O_5	0.473
Cl	0.438

A solution was made up of such strength that 40 c.c. corresponded to the ash from 1 liter of milk. Instead of using small portions diluted in Nessler tubes, the nickel was determined in a colorimeter after removing the iron. The results agree favorably with direct colorimetric comparisons of pure, dilute nickel solutions.

Summary.—Investigation has shown that a colorimetric method for the determination of nickel, based on its reaction with potassium di-thio-oxalate, may be applied to biologic material with greater facility and accuracy than the older methods described in the literature.

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Section 3

Observations on the Elimination of Nickel Ingested with Food Cooked in Nickel Containers

I. Rationale of the Experiment

Even the most cursory perusal of the material contained in Section 1[1] will suffice to show that foods cooked in nickel utensils gather nickel during the process, and that the degree to which this occurs is dependent roughly on the acidity of the food in question. Interest in the purity and preparation of foods has led to abundant and rather discordant attempts to determine the degree of this corrosion, but there are few observations—and none employing satisfactory analytic methods—on the actual amounts of nickel appearing in the urine and feces of persons whose food is prepared solely in nickel utensils. Indeed, the entire question of the appearance of nickel in the urine may be regarded as having been practically unexplored until examined by means of the method described in this monograph. While the data available are thus of unquantitative nature, they are, nevertheless, not without considerable hygienic significance. When one finds accounts of whole families who have used nickel utensils for several years without any apparent damage to health, it is quite evident that the amounts of nickel ingested in this way are certainly not harmful in any gross manner.

It seemed to us, in considering the question, that the urine side of the matter required exploration before one could be absolutely certain that widespread use of nickel cooking ware would do no harm. Even with the reassuring German evidence, if the urine of individuals using such utensils was found to contain constant large amounts of nickel, and if, on repeated examinations, albumin, red blood cells, or casts were found and it could be shown they appeared and disappeared with use and elimination of the nickel ware, then there would be sufficient ground for absolute condemnation of this type of cooking utensil.

The problem was not one which could be settled by animal experiments. Observations on human subjects under ordinary living conditions were essential. In accordance with this idea, three families were selected. They consisted of twelve individuals of different ages, and represented somewhat different types of living conditions. Their kitchens were equipped throughout with nickel utensils so that, practically with-

[1] See pp. 327-339.

out exception, all cooking and food handling, except the final serving, was done with nickel. It is improbable that any ordinary kitchen would be so completely equipped with nickel ware, and, in this regard, therefore, the experimental situation exaggerated the possibilities of nickel ingestion as far as could be managed.

It will be seen that the experiment is somewhat short—three months of actual exposure to nickel. In view, however, of the foreign experience and of the entire absence of symptoms of any sort in the subjects of the experiment, together with the constant and very definite analytic results, the authors felt that a longer period of observation was unnecessary.

II. Experimental Data

1. *The Subjects*

First Family.—Two adults, a man aged 37 (Subject No. 1), and a woman aged 35 (No. 2); a girl of 6 (No. 12), and a boy of 1½ years (No. 11). All food preparation in this family was carried out by three servants, who ate the same food and experienced no untoward effects.

Second Family.—Two adults, a man (No. 3) and a woman (No. 4) aged 35 and 31, respectively; no children nor servants.

Third Family.—Two adults, a man (No. 5) and a woman (No. 6), both 37; two girls (Nos. 7 and 8) aged 15 and 13, respectively, and two boys (Nos. 9 and 10) aged 11 and 1, respectively.

2. *The Results*

It was necessary, first of all, to determine the daily normal excretion of nickel. During a preliminary period of three months, therefore, at least six twenty-four-hour specimens of urine and of feces were collected at different times from each individual and were analyzed for nickel, according to the method described in Section 2 of this report. The data from these analyses are given in Table 1. As is shown by these figures, there is a constant slight excretion of nickel in the feces. The sources of this nickel seems to be, in the main, green vegetables and cereals, and in no case does the amount of it exceed a milligram. On two occasions early in the observations, nickel was found in urine specimens. Since later results showed nickel to be uniformly absent from normal urine, we were led to suspect that these two analyses were contaminated by nickel from nickel tongs used during the first few analyses in handling evaporating dishes.

After the observations recorded in Table 1 were concluded, the families involved were furnished with nickel utensils. When these utensils had been in use for a week to ten days, the observations recorded in Table 2 were begun. The difference between these figures and those in Table 1 is at once apparent. Fecal nickel rises—on two occasions reaching 30 mg.—and nickel appears in the urine in all except six specimens. The highest figure reached in the urine is 1.5 mg. This occurred once in a woman of 37. The next highest figure was 0.7 which occurred twice. In the main, however, the figures were much lower than these. As has been indicated, the urine showed no other abnormalities during the experiment and all the individuals involved either held their weight or, if young, grew in an entirely normal manner.

III. Discussion and Conclusions

The experiment shows that even so resistant a metal as nickel is corroded

TABLE 1.—NICKEL CONTENT IN URINE AND FECES OF TWELVE NORMAL SUBJECTS

SUBJECT	DATE	NUMBER OF SPECIMEN	URINE		FECES
			VOLUME	NICKEL CONTENT	NICKEL CONTENT
	1924		*c.c.*	*mg.*	*mg.*
1	Jan. 3	1	2500	0.15	lost
	Feb. 3	2	1270	none	0.40
	18	3	1600	none	0.40
	19	4	2050	none	0.10
	27	5	1930	none	0.30
	29	6	2740	none	0.40
	Mar. 3	7	2050	none	0.15
2	Dec. 27 (1923)	1	1200	none	0.28
	Jan. 25	2	2095	none	0.09
	Feb. 3	3	1460	none	0.15
	16	4	2260	none	0.10
	17	5	1810	none	0.15
	22	6	2520	none	0.60
3	Dec. 26 (1923)	1	1300	none	0.13
	Jan. 7	2	1490	none	0.12
	21	3	1750	none	0.37
	Feb. 4	4	1545	none	0.40
	11	5	1520	none	0.40
	18	6	1820	none	0.40
4	Dec. 27 (1923)	1	630	none	0.01
	Jan. 7	2	720	none	lost
	22	3	930	none	0.40
	Feb. 4	4	960	none	0.25
	11	5	850	none	0.25
	19	6	800	none	0.25
	26	7	930	none	0.15
5	Jan. 8	1	lost	lost	0.23
	13	2	1750	none	0.26
	16	3	1850	none	0.35
	20	4	1190	none	0.40
	27	5	1370	none	0.40
	30	6	1030	none	0.20
	Feb. 19	7	1480	none	0.60
6	Jan. 13	1	1400	none	0.15
	16	2	1300	none	0.28
	20	3	1180	none	1.00
	27	4	1175	none	0.50
	30	5	1085	none	0.37
	Feb. 19	6	1110	none	0.60

TABLE 1.—*Continued*

SUBJECT	DATE	NUMBER OF SPECIMEN	URINE		FECES
			VOLUME	NICKEL CONTENT	NICKEL CONTENT
	1924		*c.c.*	*mg.*	*mg.*
7	Jan. 8	1	1100	none	0.35
	13	2	1600	none	0.18
	16	3	1325	none	0.80
	20	4	975	none	0.60
	27	5	820	none	0.80
	30	6	965	none	lost
	Feb. 19	7	1270	none	0.40
8	Jan. 8	1	875	none	0.31
	13	2	875	none	0.11
	16	3	1200	none	0.40
	20	4	970	none	0.30
	27	5	220	none	0.50
	30	6	620	none	0.30
9	Jan. 8	1	1000	0.07	0.11
	13	2	675	none	0.32
	16	3	575	none	0.40
	20	4	675	none	0.10
	27	5	1230	none	0.30
	30	6	830	none	0.20
10	Jan. 8	1	160	none	0.05
	13	2	100	none	0.10
	16	3	200	none	0.10
	20	4	210	none	0.07
	27	5	20	none	0.07
	30	6	410	none	0.07
11	Jan. 3	1	500	none	0.07
	25	2	155	none	0.20
	Feb. 3	3	240	none	0.10
	15	4	220	none	0.10
	16	5	150	none	0.10
	22	6	180	none	0.04
12	Jan. 25	1	1010	none	0.10
	Feb. 3	2	lost	lost	0.20
	16	3	770	none	0.07
	17	4	840	none	0.40
	22	5	690	none	0.15
	23	6	430	none	0.30
	Mar. 5	7	figure lost	none	0 25

TABLE 2.—NICKEL CONTENT IN URINE AND FECES OF THE SAME TWELVE SUBJECTS WHEN EATING FOOD COOKED IN NICKEL UTENSILS

SUBJECT	DATE	NUMBER OF SPECIMEN	URINE		FECES
			VOLUME	NICKEL CONTENT	NICKEL CONTENT
	1924		*c.c.*	*mg.*	*mg.*
1	Mar. 16	1	1230	0.20	5.00
	Apr. 4	2	1330	0.15	4.00
	11	3	2230	0.30	15.00
	23	4	1960	0.15	0.70
	25	5	1355	0.15	3.50
	May 21	6	1080	0.10	0.20
	22	7	1640	0.10	1.50
2	Mar. 16	1	2490	0.25	5.00
	25	2	1355	0.10	2.00
	26	3	1810	0.07	6.50
	Apr. 24	4	1200	0.15	3.50
	May 15	5	1860	0.10	6.50
	21	6	1610	0.04	2.50
	22	7	1570	0.05	5.00
3	Mar. 11	1	1300	0.10	7.50
	15	2	1300	0.13	12.50
	25	3	1300	0.07	10.00
	Apr. 7	4	1850	none	7.50
	12	5	1270	0.07	1.25
	27	6	1225	0.09	2.50
	May 4	7	1720	0.04	2.15
4	Mar. 11	1	690	0.12	20.00
	16	2	750	0.10	0.50
	25	3	900	0.15	5.00
	Apr. 7	4	720	none	1.80
	12	5	720	none	3.50
	May 6	6	770	0.08	3.50
	20	7	650	0.04	1.25
5	Mar. 12	1	2010	0.20	5.00
	16	2	1930	0.25	30.00
	23	3	lost	lost	5.00
	Apr. 2	4	1500	0.15	4.50
	9	5	1775	0.24	30.00
	16	6	1240	1.50	5.00
	23	7	1925	0.20	15.00
	30	8	1790	0.20	11.00
6	Mar. 12	1	1260	0.22	7.50
	16	2	1320	0.25	7.00
	23	3	1400	0.15	4.00
	30	4	950	0.20	7.50
	Apr. 6	5	950	0.25	20.00
	13	6	830	0.40	10.00
	20	7	855	0.32	10.00
	27	8	1180	0.20	9.50

TABLE 2.—*Continued*

SUBJECT	DATE	NUMBER OF SPECIMEN	URINE		FECES
			VOLUME	NICKEL CONTENT	NICKEL CONTENT
	1924		*c.c.*	*mg.*	*mg.*
7	Mar. 12	1	1810	0.50	6.50
	16	2	1600	0.70	12.50
	23	3	950	0.20	7.50
	30	4	1690	0.15	10.00
	Apr. 6	5	620	0.20	5.50
	13	6	1050	0.17	10.00
	20	7	1090	0.40	23.00
	27	8	1000	0.10	6.50
8	Mar. 12	1	1460	0.15	5.00
	16	2	660	0.15	3.00
	30	3	700	0.13	7.50
	Apr. 6	4	780	0.12	1.50
	13	5	750	0.13	2.00
	20	6	1020	0.17	12.50
	27	7	1210	0.12	2.50
	May 4	8	1200	0.10	3.50
9	Mar. 12	1	720	0.09	lost
	16	2	1170	0.15	10.00
	30	3	980	0.07	2.00
	Apr. 6	4	1150	0.15	3.50
	13	5	800	0.15	6.50
	20	6	1330	0.20	1.00
	27	7	1390	0.20	6.50
	May 16	8	1250	0.40	7.50
10	Mar. 12	1	210	0.15	10.00
	16	2	120	0.15	10.50
	23	3	300	0.10	10.00
	30	4	430	0.30	10.00
	Apr. 6	5	265	0.20	7.50
	13	6	100	0.10	15.00
	20	7	230	0.15	12.50
	27	8	250	0.60	7.50
11	Mar. 25	1	165	0.23	10.00
	27	2	280	0.70	12.50
	30	3	180	0.07	10.00
	Apr. 2	4	85	0.04	10.00
	7	5	160	0.07	3.50
	20	6	185	0.07	12.50
	May 15	7	200	none	1.70
12	Mar. 16	1	750	0.04	4.00
	29	2	320	0.10	15.00
	Apr. 2	3	290	0.10	1.00
	7	4	480	0.05	3.50
	26	5	485	0.03	4.50
	May 23	6	480	none	7.50
	25	7	475	none	4.50

to some degree during ordinary cooking operations. This corrosion is, however, slight, probably far less than is the case with tin and aluminium, which have such extensive kitchen use. Some of the corroded nickel is absorbed—just how much, we cannot say—and finds its way into the urine. The maximum concentrations of nickel in the urine are, however, in our opinion, too low to be a possible source of kidney damage. In this connection, it may again be pointed out that in our experiment as many nickel utensils as possible were used. It would undoubtedly be rare for any group of people to be so completely equipped with nickel ware, but, even if a family were so equipped, the authors do not believe harm would result. Certain metals, such as arsenic, mercury, and lead, damage the kidney as they pass through it. There is apparently very little tendency for urinary excretion of nickel, and what does pass through has, in our experience, done no harm.

The experiment, then, gives a view of the daily amounts of nickel handled by individuals using nickel ware. It shows that a minute fraction of this passes out through the kidneys, but causes no observable damage. The authors are, consequently, in agreement with the large group of foreign investigators who have found that the preparation of food in nickel utensils is entirely safe.

J. I. H.
Dec., 1924

INDUSTRIAL MORBIDITY STATISTICS

Report of Informal Committee on Classification of Industrial Morbidity Statistics

Statistics of industrial morbidity, its extent and relation to the industrial life of the nation have engaged the attention of investigators for the past several years. It is realized that this problem is of great interest and importance to industrial management, to physicians doing industrial work, to statisticians, and to insurance companies that are rapidly occupying the group and health insurance field.

Investigations have shown that few attempts are made by industrial medical departments to keep statistics of their morbidity experience, and those that are kept have no common basis for comparison. The lack of adequate knowledge of this problem was still further intensified by the efforts on the part of different organizations to find some measure for it, but without success.

In order to stimulate a co-operative interest in this work and to bring about some definite action on the matter, the National Industrial Conference Board early in the year informally invited a group of physicians and statisticians who were representative of interested organizations and who were themselves interested in the subject to meet and consider the problem.

At its first meeting the committee[1] discussed the need for a standardized classification of industrial morbidity whose brevity would commend it to busy industrial medical departments but which would still be sufficiently comprehensive to provide a definite measure of the sickness experience in the industry. It was felt that none of the classifications that had been devised by individual plants was adapted to the needs of all plants, and it was decided that a classification should be developed based on the International List of Causes of Death, Third Revision.

A technical subcommittee[2] of expert statisticians was appointed to develop an abridged classification which was considered and adopted at a later meeting of the full committee. The subcommittee recognized that the question as to what diseases should be shown separately and what diseases should be combined in different groups for the many purposes of industrial morbidity statistics is a difficult one to decide. The problem was attacked by selecting from the terms included under the different groupings of the List of International Causes of Death those diseases and symptoms which it is believed will be of most interest to industry, particularly from the standpoint of studying industrial hygiene and endeavoring to reduce the frequency and duration of disability among different groups of industrial employees.

It is realized that a list of this sort, based as it is upon relatively little illness, cannot be entirely satisfactory. It can be perfected only through experience dealing with an increasing body of morbidity material. To this end a revision of the list from time to time undoubtedly will be necessary. The extent of this revision will depend entirely upon the amount of accurate information made available by those using the list, and it is hoped and urged that as many industrial medical departments as possible utilize the list in compiling statistics from their experience.

It was felt that the work of the committee should be placed under the sponsorship of some interested organization that could supply a permanent center from which the work could be directed. This the U. S. Public Health Service has agreed to do, and it is expected that a permanent advisory committee, representative of the interests that have been active in the work of the committee thus far, will be formed to assist in the further development of the work.

[1]This committee consists of: Dr. Wm. H. Davis, Bureau of Census; Mr. H. N. Dambmann, National Safety Council; Dr. Louis I. Dublin, American Statistical Association; Dr. R. S. Quinby, American Association of Industrial Physicians and Surgeons; Dr. F. L. Rector, Conference Board of Physicians in Industry, Secretary; Mr. Edgar Sydenstricker, U. S. Public Health Service, Chairman; Dr. Wade Wright, American Public Health Association.

[2]This committee was as follows: Mr. Dean K. Brundage, U. S. Public Health Service; Mr. Geo. H. Van Buren, Metropolitan Life Insurance Co.; Mr. J. O. Spain, Bureau of Census.

The committee feels that it has made at least a beginning upon a work of great importance both to industry and to the community at large. If this classification is carefully used in recording sickness experience it will give a fair indication of the extent of disability from illness in any given industry, and if the logical interpretation of the data is carried out it will be possible to obtain information of great value regarding causes and extent of absenteeism and of lowered production.

The list as adopted by the committee is as follows:

List of Diseases and Pathologic Conditions, for Industrial Morbidity Statistics, with Corresponding Title Numbers in Parentheses from the International List of the Causes of Death, Third Revision, Paris, 1920

I. Epidemic, Endemic, and Infectious Diseases
  1. Typhoid and paratyphoid fevers (1)
  2. Malaria (5)
  3. Influenza (11)
  4. Other epidemic and endemic diseases (2-4, 6-10, 12-25)[3]
  5. Tuberculosis, all forms
    a. Tuberculosis of the respiratory system (31)
    b. Other forms of tuberculosis (32-37)
  6. Venereal diseases
    a. Syphilis
      1. Syphilis, so reported (38)
      2. Locomotor ataxia and general paralysis of the insane (72 and 76)
    b. Chancroid (39)
    c. Gonorrhea, all forms (40)
  7. Purulent infection, septicemia (41)[4]
  8. Other infectious diseases, exclusive of those under 4
    a. Anthrax (27)
    b. Other diseases in this group (26, 28-30, 42)[3]

II. General Diseases not Included in Class I
  1. Cancer and other malignant tumors, all forms and all sites (43-49)
  2. Benign tumors and tumors not reported as malignant (50)[5]
    a. Non-malignant
    b. Unqualified
  3. Rheumatism[6]
    a. Acute rheumatic fever (51)
    b. Chronic rheumatism, osteo-arthritis, gout (52)
  4. Alchoholism, acute or chronic (66)
  5. Chronic poisoning
    a. Inorganic (67)
    b. Organic substances (68)[7]
  6. Other general diseases (53-65, 69)[7]

III. Diseases of the Nervous System and of the Organs of Special Sense
  1. Neuralgia, neuritis, hysteria (82)[8]
    a. Neuralgia
    b. Neuritis
    c. Sciatica
    d. Migraine
    e. Hysteria
    f. Others under this title
  2. Other diseases of the nervous system
    a. Functional nervous disorders, such as neurasthenia, nervous prostration, nervousness, etc. (84)
    b. Others under this title (70, 71, 73-75, 77-81, 83)[9]
  3. Diseases of the eye and annexa (85)
    a. Conjunctivitis
    b. Eyestrain
    c. Foreign body in the eye
    d. Others under this title[10]
  4. Diseases of the ear (86a)
    a. Earache
    b. Otitis media
    c. Others under this title
  5. Diseases of the mastoid process (86b)

IV. Diseases of the Circulatory System
  1. Diseases of the heart (87-90)
  2. Diseases of the arteries (91)
    a. Arteriosclerosis (91b)
    b. Others under this title (91a and 91c)

[3]Should any of the diseases included in this group indicate marked prevalence, they should be shown separately.

[4]When not due to an accident.

[5]This title does not include tumors of the female genital organs, tumor of the brain, tumor of the thyroid gland, tumor of the prostate, etc. (See Tumor in Index of the Manual of the International List of Causes of Death, Third Revision, p. 292.)

[6]Illness due to rheumatism is subdivided into acute and chronic, in accordance with the detailed International List of the Causes of Death. Probably so many cases will be reported as due to "rheumatism" without any qualification that it will be impracticable to determine which of the two conditions actually caused the illness; but inasmuch as acute rheumatic fever, a disease which has epidemic prevalence, differs so markedly from arthritis deformans, a disease of the joints of doubtful etiology which ordinarily pursues a chronic course, it is felt that the subdivision should be maintained, and an effort made to obtain the information necessary for the proper classification of rheumatism. If it is found to be impracticable in certain instances to obtain this information, it is recommended that rheumatism, unqualified, be placed in subdivision "a" (acute rheumatism) in accordance with the International List. This title does not include "muscular rheumatism."

[7]Included under this title are all poisonings other than those of a sudden accidental character. (See International Titles 175-177 and 181.) Should any of the diseases included in this group indicate marked prevalence, they should be shown separately.

[8]Hysteria appears to be out of place in this title, but inasmuch as it is included with neuralgia and neuritis in the International List of the Causes of Death, it was deemed advisable to keep it in the same place in this list, and to show the number of such cases by providing subtitle "e."

[9]Titles 72 and 76 in the International List (locomotor ataxia, and general paralysis of the insane) should be added to title 38 (syphilis).

[10]Should trachoma or certain other diseases of the eye show marked prevalence, subdivisions should be added for these diseases.

J. I. H.
Dec., 1924

3. Diseases of the veins (93)
   a. Hemorrhoids
   b. Phlebitis
   c. Varicose veins
   d. Others under this title
4. Diseases of the lymphatic system (94)
   a. Adenitis and swollen glands[11]
   b. Others under this title
5. Hemorrhage without specified cause (95)
   a. Epistaxis
   b. Others under this title
6. Other diseases of the circulatory system (92, 96)
   a. High blood pressure (96)
   b. Others under this title (92, 96)

V. Diseases of the Respiratory System
1. Diseases of the nasal fossae and their annexa (97)
   a. Coryza, rhinitis, and "cold," unqualified
   b. Sinusitis
   c. Others under this title
2. Diseases of the larynx (98)
   a. Laryngitis
   b. Others under this title
3. Bronchitis (99)
   a. Acute, excluding capillary bronchitis; see 4a
   b. Chronic
   c. Unspecified
4. Pneumonia, all forms (100, 101)
   a. Bronchopneumonia, including capillary bronchitis (100)
   b. Lobar pneumonia (101a)
   c. Other forms of pneumonia, including pneumonia unspecified (101b)
5. Pleurisy (102)
6. Asthma (105)
7. Other diseases of the respiratory system (tuberculosis excepted)
   a. Pneumonokoniosis (107a)[12]
   b. Cough, unqualified (107c)
   c. Hay-fever (107c)
   d. Others under this title (103, 104, 106, 107)

VI. Diseases of the Digestive System
1. Diseases of the mouth and annexa (108)
   a. Toothache, unqualified
   b. Abscessed tooth
   c. Pyorrhea alveolaris
   d. Other conditions of the teeth or gums
   e. Canker of mouth, unqualified
   f. Others under this title
2. Diseases of the pharynx and tonsils (109)
   a. Diseases of the pharynx
   b. Diseases of the tonsils
   c. Sore throat, unqualified
   d. Streptococcic sore throat
   e. Others under this title
3. Diseases of the stomach (111, 112)
   a. Gastric and duodenal ulcer
   b. Gastritis
   c. Dyspepsia and indigestion, unqualified
   d. Nervous indigestion
   e. Nausea, vomiting
   f. Stomach trouble, unqualified
   g. Others under this title
4. Diarrhea and enteritis (114)
5. Appendicitis (117)
6. Hernia, intestinal obstruction (118)[13]
   a. Hernia
   b. Intestinal obstruction (organic obstructions only)
7. Other diseases of the intestines
   a. Constipation (119)
   b. Others under this title (115, 116, 119)
8. Diseases of the liver and gallbladder
   a. Jaundice (124)
   b. Cholecystitis (124)
   c. Gallstones (123)
   d. Others under this title (120-124)
9. Peritonitis without specified cause (126)
10. Other diseases of the digestive system (110, 125, 127)
   a. "Cramps"[14]
   b. Others under this title

VII. Non-Venereal Diseases of the Genito-Urinary System and Annexa
1. Nephritis, acute and chronic
   a. Acute (128)
   b. Chronic, including unspecified (129)
2. Diseases of the bladder (133)
   a. Cystitis
   b. Others under this title
3. Non-puerperal diseases of the female genital organs
   a. Menstrual disorders (140, 141)
   b. Others under this title (137-141)
4. Other non-venereal diseases of the genito-urinary system and annexa (130-132, 134-136, 142)

VIII. The Puerperal State (143-150)

IX. Diseases of the Skin and of the Cellular Tissue
1. Furuncle (152)
2. Abscess, unqualified (153)
3. Acne (154)
4. Dermatitis venenata (154)
5. Eczema (154)
6. Herpes zoster (154)
7. Impetigo contagiosa (154)
8. Pruritus (154)
9. Urticaria (154)
10. Ulcer, unqualified (154)
11. Others under this title (151, 153, 154)

X. Diseases of the Bones and of the Organs of Locomotion

[11]Include abscesses of the axilla, groin, cervical, and other lymphatic glands.

[12]This includes fibrosis, silicosis, and other changes produced by dust and other irritating agents.

[13]When not due to an external cause.

[14]A report of "cramps" in a male generally means, it is believed, some stomach or intestinal disturbance which rightly belongs under diseases of the digestive system instead of under convulsions, as given in the International List. In fatal cases, however, "cramps" should be allocated to the convulsions title. Cramps due to menstrual disorders should be classified under VII, 3, a.

1. Diseases of the bones, tuberculosis excepted (155)
2. Diseases of the joints (tuberculosis and rheumatism excepted) (156)
3. Amputations
4. Other diseases of the organs of locomotion (158)
   a. Bursitis
   b. Flatfoot
   c. Lumbago
   d. Myalgia, including "stiff neck," etc.
   e. Myositis
   f. Others under this title

XIV.[15] External Causes

A. Accidents, occupational
   1. Accidental burns, conflagration (178, 179)
   2. Accidental asphyxiation by poisonous gas or vapor (181)
   3. Accidental cuts or punctured wounds (184)
   4. Accidental falls (185)
   5. Excessive cold (193)
   6. Excessive heat (194)
   7. Fractures, sprains, luxations (201)
   8. Other external causes
      a. Infected wound (202)
      b. All others (165-174, 177, 180, 182, 183, 186-192, 195-200, 202, 203)

B. Accidents, non-occupational or unqualified
   1. Poisoning by food (175)
      a. Ptomain poisoning
      b. Others under this title
   2. Other acute accidental poisonings (gas excepted) (176-177)
      a. Ivy poisoning (177)
      b. Others under this title (176, 177)
   3. Accidental burns, conflagration (178, 179)
   4. Accidental asphyxiation by poisonous gas or vapor (181)
   5. Accidental cuts or punctured wounds (184)
   6. Accidental falls (185)
   7. Excessive cold (193)
   8. Excessive heat (194)
   9. Fractures, sprains, luxations (201)
   10. Other external causes
      a. Infected wound (202)
      b. All others (165-174, 180, 182, 183, 186-192, 195-200, 202, 203)

XV. Ill-Defined and Unknown Causes (205)
   1. Headache
   2. Exhaustion[16]
   3. Backache
   4. Biliousness
   5. Fever
   6. Fainting
   7. Dizziness
   8. Other ill-defined conditions
   9. Cause unknown

XVI. All Other Causes (159-164, 204)

[15]Groups XI and XII are omitted because they are diseases and conditions of no industrial importance. Group XIII is omitted because "old age" is rarely reported as a cause of disability on account of the fact that there are very few really old persons in industry. It is felt that senility could just as well be classified as "general debility" in the Ill-defined group.

[16]Including debility, weakness, fatigue, overwork, general rundown condition and the like.

SUBJECT INDEX TO VOLUME VI

This is a subject index to all the reading matter in the JOURNAL OF INDUSTRIAL HYGIENE, and one should, therefore, look for the subject word, with the following exception: "Book Notices" are indexed under this title on page 362. The name of the author follows the subject entry in parentheses.

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ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE

SUPPLEMENTARY TO

THE JOURNAL OF INDUSTRIAL HYGIENE

EDITORS

DAVID L. EDSALL, M. D., S. D., United States

EDGAR L. COLLIS, M. D., M. R. C. S., Great Britain

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ABSTRACT OF THE LITERATURE

OF

INDUSTRIAL HYGIENE

VOLUME VI MAY, 1924 NUMBER 1

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GENERAL

INDUSTRIAL DISEASES AND INJURIOUS PROCESSES. *T. M. Legge. Internat. Labour Office, Studies and Reports, Series F, No. 9, Dec., 1923, pp. 49-52.*

The author points out that an integral part of the work of the League of Nations is the protection of the worker against sickness, disease, and injury arising out of his employment, and that the International Labour Office has already paid attention to some matters dealing with industrial diseases. In this branch of work obscure problems are constantly arising, for the elucidation of which information is needed which can only be forthcoming from other countries. Manganese poisoning is an instance in point. First described in America, it has now been recognized in Great Britain. The International Labour Office should be congratulated upon the start which it has made and should be warmly supported.—E. L. C.

INDUSTRIAL DISEASES AND INJURIOUS PROCESSES. *E. L. Collis. Internat. Labour Office, Studies and Reports, Series F, No. 9, Dec., 1923, pp. 53-54.*

The need for a central knowledge exchange, especially with regard to the diseases of miners, is dealt with. Knowledge with regard to metalliferous mining at home and abroad was needed before the peculiar toxic nature of silica dust could be recognized. Miners' nystagmus is quoted as a disease concerning which much information is still needed from other countries than Great Britain, while septic infections of the knee, hand and elbow among miners are important diseases which have not yet been studied internation-

ally. An international study of the relation of climate to human efficiency would be of immense value in ascertaining the conditions necessary to maintain health and improve efficiency. The acquirement of knowledge is power, a power upon which the League of Nations may surely rest.

MEDICAL RESEARCH COUNCIL REPORT FOR THE YEAR 1922-1923. *H. M. Stationery Office, pp. 143.*

Readers of this report must be struck by the wide range of research work in progress. The report deals with such general matters as filter-passing organisms, standardizing cultures, sera and antitoxins, parasitic protozoölogy, physiological efficiency, applied optics, biological and anthropometric statistics, as well as with specific subjects, such as rickets, nutrition, insulin, arthritis, cancer, diphtheria, tuberculosis, Graves' disease and many others.

A considerable volume of work in the field of industrial medicine is reported as in progress. Among the subjects under investigation are: dust inhalation and the seeming harmlessness of coal and shale dust; miners' nystagmus; miners' "beat knee," "beat hand," and "beat elbow;" industrial health statistics, including the incidence of sickness in miners and quarrymen, the sickness rates of printers, industrial dietaries, and the occupational incidence of cancer; the physiology of muscular work; industrial psychology; the legibility of type; lighting and illumination; the optimum length of spell; accident causation; ventilation; and machine design.

Information that the Council has an annual grant of only £130,000 wherewith to activate all that it has on hand indicates at once how economically it proceeds and how much energy and time is given gratuitously. Interest will be provoked when many of the reports promised are published.—E. L. C.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

CENTRAL NERVOUS SYSTEM

RÔLE OF TRAUMA IN THE ETIOLOGY OF ORGANIC AND FUNCTIONAL NERVOUS DISEASE. *S. A. K. Wilson. Jour. Am. Med. Assn., Dec. 29, 1923, vol. 81, pp. 2172-2178.*

The author discusses at some length the rôle of trauma in the causation of organic nervous disease (cerebral tumor, disseminated sclerosis, and neurosyphilis), epilepsy, and functional nervous disease following, for example, spinal concussion. In his opinion, trauma is rarely, if ever, a causative factor in the development of these conditions, and he emphasizes the urgent need for scrupulous care and faithful scrutiny—especially in the event of litigation for compensation—of all the facts of every case.—K. R. D.

RESPIRATORY SYSTEM

THE COMMON COLD. *E. O. Jordan, J. F. Norton, and W. B. Sharp. Abstr. as follows from Jour. Infect. Dis., Nov., 1923, vol. 33, p. 416, in Jour. Am. Med. Assn., Dec. 22, 1923, vol. 81, pp. 2146-2147.*

Sixteen hundred students from Chicago, California, Pasadena and Galveston, Texas, furnished the data reported on by Jordan, Norton, and Sharp. The results of their laboratory investigations correspond, in the main, with those obtained by other investigators. No one organism or group of organisms has been shown to predominate during colds. The question of a specific infectious virus is, therefore, still open. The common cold generally starts in the nose. About one-third of these colds extend to the chest. The sequence of the local symptoms in colds is not uniform. There is no definite correlation between type, duration, severity and frequency of colds, except that infrequent colds tend to run a milder course. In the California and Galveston groups, colds, while of about the same yearly frequency as in the Chicago group, tended to be concentrated into a shorter period, were of somewhat less severity and of somewhat shorter duration. In general, however, the differences in the three groups were less than might be expected on the basis of climatic conditions alone. Of the persons from whom data were gathered, 64 per cent.

lieved that their colds were induced by ne strain on the heat regulating mechanism the body. Possible contact with others aving colds was stated by 22 per cent. of ersons questioned to have preceded their n colds. "Resistance building" practices pparently had little effect on the frequency colds. The data do not show that nose or throat operations result in a marked reduction of the frequency of colds. Whether or not a cold is the result of a specific infectious process is unknown. It is clear, however, that outside influences, particularly those involving chilling of the body, may serve to induce a cold, even if these influences cannot be regarded as the most important etiologic factors.—K. R. D.

ONE YEAR OF COMMON COLDS. *Jour. Am. Med. Assn., Dec. 22, 1923, vol. 81, p. 2124.*

In a group of about 6,700 clerical employees at the home office of the Metropolitan Life Insurance Company there were 2,824 cases of "colds" which involved disability for work during the year ending July 28, 1923. These affections occurred, therefore, at a rate of 420.7 per thousand employees for the year. The average number of days of disability for this illness per person on the payroll was 0.9, and the average number of days per case was 2.2. In all there were 6,233 days lost for the year for these conditions which included coryza, acute bronchitis and tracheitis. There appeared to be two periods of maximum incidence for these infections: the first, following the advent of cool weather in the early fall; the second, when the coldest weather of winter prevails, the following January or February. These data indicate that there are distinct relationships between the respiratory infections and changes in the weather. For example, a drop of 10 degrees in the weekly mean temperature carries with it an increase of eighteen common colds per week in this group of 6,700 people. On the other hand mean relative humidity and total precipitation showed only slight influence on the incidence of colds.—K. R. D.

SPIROMETRIC EXAMINATION OF MINERS. A DISCUSSION OF THE CAUSE OF EMPHYSEMA. *H. Tammann and O. Bruns. Abstr. as follows from Ztschr. f. d. ges. exp. Med., 1923, vol. 33, pp. 350-367, in Zentralbl. f. d. ges. Hyg., Sept. 10, 1923, vol. 5, p. 36.*

The results of the examination of thirty miners were as follows: The effect of every physical exertion is a temporary inflation of the lungs which is accentuated in miners by the high air pressure. Working underground increases residual air and therefore the average capacity. Whereas such acute inflation of the lungs usually disappears very quickly in youth, return to normal becomes slower with increasing age. Individual fluctuations, of course, occur. The normal quantity of residual air determined by Bohr as 32.3 per cent. of the total capacity is exceeded by the miner working in the pit of salt mines when he is only about 42 years old. This condition is not clinical pulmonary emphysema. True pulmonary emphysema, which is often observed in older miners working in coal and metal mines, is the result of chronic bronchitis caused by the dampness and drafts in the shafts.—L. T. F.

THE DIAGNOSIS OF SILICOSIS. *W. Watkins-Pitchford. Med. Jour. Australia, Oct. 13, 1923, vol. 2, pp. 382-384.*

Dr. Watkins-Pitchford stresses the use of the radiograph in the diagnosis of pulmonary silicosis. He believes that other symptoms and signs are only presumptive evidence of the disease and that a satisfactory radiograph of the chest is necessary in order to determine the diagnosis definitely. Ordinary clinical examination is useful to estimate "the degree of disability and to establish a basis for prognosis." He recommends that a "duplitized" film be placed beneath the chest of the patient, who lies in a prone position, and that the exposure be for not more than one second and a half with the thorax absolutely motionless. Many postmortem examinations have established the fact that silicosis, except in the earliest stages, will always show specific changes in the negative. "The specific radiographic sign of early silicosis is a fine uniformly distributed and symmetrical mottling of both lung areas." The author considers that this condition is not present in any other form of pulmonary disease. Tuberculosis, he states, gives a coarser and an asymmetric mottling. Syphilis sometimes simulates the lesions seen in pulmonary silicosis. The Wassermann should be used to rule this condition out. Very often tuberculosis and silicosis are both present, sometimes the former preceding the latter and some-

times the latter preceding the former. The presence of tuberculosis modifies the specific lung changes as seen in pulmonary silicosis. The author concludes his brief review of the diagnosis of silicosis by stating that the "asthenic" heart is commonly seen in cases of pulmonary silicosis and more frequently in cases of tuberculo-silicosis though not pathognomonic of either of these conditions.—H. B. E.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

PROGRESS REPORT OF COMMITTEE ON BENZOL POISONING. *National Safety Council, Chemical Section, Aug. 20, 1923.*

As a result of papers presented by C. F. Horan (see THIS JOUR., 1922-23, vol. 4, Abstr. Section, p. 161) and W. S. Paine at the 1922 National Safety Congress in Detroit, a committee was formed to go more thoroughly into the question of benzol poisoning.

The first, or so-called progress, report of the committee consists of a ten-page bibliography, a brief statement of the medical aspects of benzol poisoning, a statistical survey of firms using benzol in quantities of industrial or hygienic interest, and a list of tentative recommendations which are quoted herewith:

1. The use, where possible, of enclosed apparatus for the handling of benzol.

2. The use of special exhaust ventilation where employees are exposed to the fumes of benzol:

a. where benzol is evaporated at room temperatures, air removal by general room ventilation with down-draft is recommended, although in certain enclosed processes where negative pressure can be applied, direct ventilation (from the enclosure) with upward draft may be indicated.

b. where localized heat is applied in the evaporation of the benzol, hoods or enclosures should be provided with up-draft. This draft should be sufficiently intensive and applied closely to the point of origin of the evaporating benzol to insure the complete removal of all of the benzol before the heated surface is removed from the hood or enclosure. This recommendation deals with specific processes where sufficient upward air movement is created by the heated surface to overcome the natural density of the benzol vapor.

3. The use of special exhaust ventilation for tank cars and other containers together with the use of special protective breathing apparatus in the cleaning of tanks and other enclosed spaces where benzol may constitute a hazard. The committee does not recommend the use of ordinary commercial respirators as a means of preventing the absorption of benzol fumes.

4. Physical examination of all new employees with the object of excluding from benzol processes applicants suffering from:

a. organic diseases of heart, lungs, or kidneys.

b. hemorrhagic tendencies.

c. anemia or any unusual blood picture.

5. Frequent re-examination of all employees exposed to benzol and the temporary exclusion from benzol processes when examination reveals the presence of:

a. hemorrhages from the mucous membranes of the nose, mouth, or other organs.

b. decrease of more than the following from the employee's normal blood picture (normal conditions will be obtained from previous examinations of the individual employee):

I. white cells, decrease of 25 per cent.; but in no case should an employee with a white cell count of less than 5,000 be continued in benzol processes.

II. red cells, decrease of 25 per cent.

III. hemoglobin, below 70 per cent.

(Note: Reduction in white cells is the most important condition to be noted. Still more delicate and specific is the change in ratio of the various types of white cells.)

6. Investigation of absence from work by persons familiar with the symptoms of benzol poisoning.

7. Detailed record of the results of physical examinations, duration of symptoms and treatment of illnesses.

8. The employee should be made acquainted with the symptoms which demand early medical attention.

J. I. H.
May, 1924

9. A liberal policy of inter-department transfers for employees presenting minor symptoms of acute benzol poisoning.—P. D.

CHRONIC BENZOL POISONING. *Brücken. Deutsch. med. Wchnschr., Aug. 24, 1923, vol. 49, pp. 1120-1121.*

According to Brücken, the following two cases, which occurred in rubber manufacture, are the first instances of chronic benzol poisoning reported in Germany. The poisoning was found in women who were using benzol rubber cement to fasten together the two halves of rubber balls. The room in which they worked was kept hot and draftless for fear of injury to the product. After employment for about two and a half years, Case 1, a woman 22 years old, began to feel ill; she found it hard to climb stairs and suffered from headache and somnolence. Six months later, when Brücken saw her, she was complaining of violent headache, great exhaustion, palpitation of the heart, and cough. He found a temperature of 101° F. and a weak, rapid pulse, 100 per minute. A diagnosis of grip was made, but while the cough and headache subsided, fever and rapid heart action persisted, exhaustion increased, and her pallor was striking. Brücken then elicited a history of excessive menstruation coming on every three weeks and lasting eight to ten days, and the fact that the lightest blow produced big black and blue marks on the skin. Bleeding from the gums was frequent, and occasionally blood came with the stools. A blood examination showed hemoglobin, 26 per cent. (Sahli), very striking leukopenia, few platelets, striking anemia, polychromasia and anisocytosis, but no normoblasts. Bleeding time was very prolonged, the drops coming without any diminution for sixteen minutes, when the observation was broken off. Treatment brought about no improvement for some time; the temperature persisted at 100 to 101, bleeding from the gums and intestines and two periods of excessive menstrual flow brought great exhaustion—the patient slept practically all the time. At the end of four weeks in bed improvement began, and at the end of two months more convalescence was well established. The blood counts at the beginning and end were as follows:

	Feb. 14	Apr. 22
Hb.	32%	81%
Color index	1.05	1.02
R. b. c.	1,515,000	3,990,000
W. b. c.	2,460	6,833
Platelets	24,240	155,610
Bleeding time	16 min.	2 min.
Neutrophiles	48%	69%
Lymphocytes	42%	24%
Mononuclears	10%	6%
Eosinophiles	—	1%

The second case, that of a woman 23 years old who was also employed at this work for three years, was much less severe. The symptoms were similar—malaise, frequent headache, bruised spots on slight injury, and menstruation at shortened intervals. Examination showed mottling of the skin of the arm. The blood findings were: hemoglobin, 43 per cent., slight polychromatophilia and anisocytosis; differential count of whites: neutrophiles, 47 per cent.; lymphocytes, 38 per cent.; mononuclears, 12 per cent.; and eosinophiles, 3 per cent.—A. H.

PRACTICAL APPLICATION OF PRONE PRESSURE METHOD OF RESUSCITATION. *M. C. Goodspeed. Safety Engin., Dec., 1923, vol. 46, pp. 307-309.*

Ordinary directions for the application of the prone pressure method of resuscitation place the operator's knees below the patient's hips; the technic outlined in this article requires that the knees be above the patient's hips. This brings the operator's arms into practically a perpendicular position and his body is in such a position that all of his weight can be readily shifted from his knees to his arms. The second change suggested is that the elbows be snapped open at the end of the downward stroke, thereby removing the pressure as quickly as possible. This quick release allows the ribs of the patient to act as a spring causing a vacuum in the chest and increasing the volume of air drawn in. Under the new technic the physical strain on the operator is much less than under the old method.—M. F. M.

DANGERS FROM CARBON MONOXIDE GIVEN OFF BY HEATERS BURNING NATURAL GAS. *G. W. Jones and W. P. Yant. Jour. Am. Soc. Heating and Ventil. Eng., Dec., 1923, vol. 29, pp. 669-681.*

A practical and instructive paper on tests

made by the Bureau of Mines of various types of gas heaters in order to determine the dangers from carbon monoxide poisoning. A detailed discussion, with illustrations, of the heaters is given. In their summary the writers state that "... the two outstanding causes [of carbon monoxide production] are: (1) operating at excessive gas rates, and (2) in the case of the blue and non-luminous flame heaters, operating at too low a primary air-gas ratio."—P. D.

INVESTIGATIONS IN THE TYPEFOUNDING INDUSTRIES. *A. Seitz. München. med. Wchnschr., Dec. 21, 1923, vol. 70, pp. 1501-1503.*

Investigations of the typefounding industries and allied occupations revealed that there is practically no danger of lead poisoning by breathing the fumes. The temperature is below that which volatilizes the lead. If there is any danger, it comes from the habit of eating in the workrooms, where dust accumulates.

The relative lymphocytosis, occasional eosinophilia, and reduction in the platelet count are due to the arsenic used in the type. No stippling was found in seventy-six founders. One cutter had stippling.

The author concludes that the body develops a reaction to the lead so that stippling does not manifest itself. He urges personal hygiene as the remedy for this industrial problem.—P. R.

ANTIDOTE TO MERCURIC CHLORID. *M. A. Rakusin and A. N. Nesmejanow. Abstr. as follows from München. med. Wchnschr., Nov. 23, 1923, vol. 70, p. 1409, in Jour. Am. Med. Assn., Jan. 26, 1924, vol. 82, p. 344.*

Rakusin and Nesmejanow's experiments demonstrate the superiority of vegetable charcoal over other absorbing materials, including animal charcoal, in the treatment of mercuric chloride poisoning.—K. R. D.

PRELIMINARY NOTE ON OBSERVATIONS MADE ON PHYSICAL CONDITION OF PERSONS ENGAGED IN MEASURING RADIUM PREPARATIONS. *R. C. Williams. U. S. Pub. Health Rep., Dec. 21, 1923, vol. 38, pp. 3007-3028.*

This report presents the observations made during the period from January, 1922, to July, 1923, on the physical condition of the persons employed during that time in the radium section of the United States Bureau of Standards.

The following conclusions are drawn:

1. At least two persons, one an employee at the time of the study and one a former employee, who were examined during this study, presented symptoms showing evidence of the effect of radiation upon the skin of the fingers and hands.

2. Employees are exposed to radiation, as is evidenced by positive effects upon dental films worn by employees in regular routine work.

3. Apparently certain blood changes had occurred in the workers; notably, a tendency in the polymorphonuclear neutrophiles to remain slightly below the lower normal limit, and a diminution in the small lymphocytes, while the large lymphocytes apparently ran somewhat higher than normal. The total white cells had a tendency to decrease in number, as also had the total red cells.

4. A low blood pressure, as compared with the usually accepted normal, was noted in practically all the employees of the section. Recommendations for minimizing the dangers are given.—B. C.

ON THE EXPERIMENTAL PRODUCTION OF TAR CANCER. *U. Parodi. Abstr. as follows from Pathologica, 1923, vol. 15, pp. 569 and 604, in Med. Science, Feb., 1924, vol. 9, p. 422.*

The author has experimented with various tar components and has studied the influence of the grafting of fragments of fetal tissues into normal mice which afterwards underwent the usual tar treatment. The general conclusion reached is as follows: the production of a tar cancer is not due to a general indirect action of either the tar or its components on the organism of the experimental animal, but to a direct action on the tissues to which the tar is applied. The previous grafting of fetal tissues has no influence on the development of a tar cancer.

CRITICAL REMARKS CONCERNING EXPERIMENTAL PRODUCTION OF CANCER. *A. Philippson. Deutsch. med. Wchnschr., July, 1923, vol. 49, p. 911.*

Philippson believes that there is little value in repeating the many successful experiments in the production of cancer by application of

arious coal-tar mixtures. He advises a re-urn to the field of clinical observation of uman cases, and an experimental study with mple bodies of known chemical composition. he coal-tar distillates which have been used ontain a number of bodies even when one of he fractional distillates is used. Moreover, ar cancer is only one of several forms of ew growth, such as chimney-sweeps' carci-noma, the carcinoma of pipe smokers, and paraffin, aniline, and roentgen ray carcinoma, which are set up by chemical bodies. After analyzing the clinical cases in the literature, Philippson came to the conclusion in 1914 that the active agent would be found to be a nitrog-enous organic base, and he quotes the obser-vation made in 1919 by Nassauer, who traced the carcinoma of coal-tar dye workers to ani-line and benzidine. He urges the use of the following substances in future experimental work: aniline and benzidine, nicotine (pyri-dine-methyl-pyrrolidine), scarlet red (ami-doazotoluol), and Congo red (a benzidine compound), acridine and choline.

Finally he discusses the phenomenon, often observed, that the development of a carci-noma does not cease when the chemical agent which excited it is no longer applied. The explanation, he believes, is that the cell has been changed not only morphologically but physiologically, that it has become capable of securing nourishment for itself by destroy-ing the albuminous bodies of the neighboring cells. This is why such growths are always surrounded by an inflammatory reaction. He represents the process of break-up of the al-buminous bodies as follows: the amino acids are normal constituents of albuminous bodies; abnormal products of break-down are the amino bases, among others putrescine and cadaverine (tetramethylenediamine and pen-tamethylenediamine). Of these, cadaverine passes easily from the chain to the ring form and forms a pyridine derivative which must be regarded as one of the carcinoma-producing bodies.—A. H.

PRELIMINARY EXPERIMENTAL STUDIES OF THE PROBLEM WHETHER THE REMOVAL OF THE OIL OF THE EPIDERMIS INCREASES ITS PERMEA-BILITY BY TAR AND SO FAVORS THE DEVELOP-MENT OF EPIDERMAL CANCER. *L. Blumenthal. Abstr. as follows from Ztschr. f. Krebsforsch., 1923, vol. 20, pp. 1-9, in Zentralbl. f. d. ges. Hyg., Sept. 25, 1923, vol. 5, p. 134.*

The author assumes that the susceptibility of certain mice to experimental tar cancer and the immunity of rats and of other species of mice is to be found in the protective mech-anism of the epidermis, especially the oil of the epidermis, which decreases the permea-bility of the skin. This assumption leads to the question whether such differences may be changed by treating the skin with special chemical substances. The use of ether for the removal of epidermal oil seemed, in view of its three-fold action (solubility of skin oils in ether, cold due to evaporation, and narcotic effect on the cells), to be unsuitable. The author used petroleum ether (which has a higher boiling point, evaporates less readi-ly, and therefore does not chill the skin as much) in an experiment in which he irrigat-ed the skin of a rabbit's ear by means of a gauze-wick (using 25 to 30 c.c. in three min-utes) and found that histologic specimens confirmed his theory that the epidermal oils had a protective action on the skin.—L. T. F.

DUST HAZARDS AND THEIR EFFECTS

POWDERED COAL HAZARDS IN INDUSTRY. *H. G. Jacobsen. Nat. Safety News, Jan., 1924, vol. 9, pp. 25-26.*

In the cement industry coal dust explosions are particularly likely to occur in connection with cleaning of coal houses, repairs on coal house machinery, and operation of the coal mill.

Careful attention to the construction of the coal mill will lessen the danger from explo-sions. The coal mill should be in a separate building of fireproof construction, and should be well ventilated and well lighted. The drier room should be separated from the mill room by a fireproof wall. All walls should be smooth with no projections of any kind, and the design should be such that beams, trusses, etc., can be entirely eliminated. Platforms and stairways should be of metal of open de-sign so as to prevent the lodging of dust. In a clean plant nothing more than local dam-age usually results from an explosion, but in

a dirty plant the explosion may be propagated from point to point and may result in extensive destruction of property and loss of life. The motors driving the grinding mills should be placed in a special room separated from the mill room by a fireproof wall. Emergency stop buttons should be placed outside the building as well as at various places in the mill room. The grinding mills should be dustless and all screw conveyors and elevators should be so constructed that no dust can escape.

Education of employees to a proper realization of the dangers involved so that they will handle coal dust with the same care that they would give dynamite is necessary if explosions are to be avoided.—M. F. M.

A Discussion of the Effect of Dust on the Lungs of Porcelain Workers. *Holtzmann and Harms. Abstr. as follows from Tuberkul. Bibliothek, 1923, No. 10, pp. 1-29, in Zentralbl. f. d. ges. Hyg., Oct. 10, 1923, vol. 5, p. 160.*

The authors first discuss the actual situation in regard to the problem. Clinical examinations are not enough; roentgenography is also necessary for the proper differential diagnosis between "dust-lungs" (*Staublunge*) and tuberculosis. Previous investigators have not paid sufficient attention to this fact. The present research is based on material drawn from two porcelain factories in Baden—one in a city, the other in the country. Sickness statistics and death records are unreliable because the diagnoses are not to be depended upon. Forty-one cases, in which suspicion of lung trouble arose only after many years' employment in the trade, were chosen out of all the employees to be further examined. A roentgenogram was made of each of these cases. "Dust-lungs" (*Staublunge*) has very few symptoms; it is only in combination with chronic bronchitis or bronchiectasis that it leads to dust-sickness (*Staubkrankheit*). One never finds cases of "dust-lungs" before the fifth year of employment, or of dust-sickness before the thirtieth year of employment in porcelain factories. Tuberculosis is of no great importance among porcelain workers. Such cases as do exist tend to be of a mild type, owing to the absorption of porcelain dust containing silicic acid. There is no necessity for tuberculous porcelain workers to leave their employment.—L. T. F.

Tobacco Dust and Mucous Membrane of the Mouth. *Fischer. Abstr. as follows from Ztschr. f. Hyg., vol. 99, p. 296 in Nation's Health, Jan., 1924, vol. 6, p. 48.*

A new industrial disease is reported by Fischer, a somewhat severe inflammation of the mucous membranes of the mouth, particularly at the base of the lower front teeth, occurring among cigar makers as a result of the irritation set up by tobacco dust.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

Transactions of the Ninth Annual Conference of the National Association for the Prevention of Tuberculosis, 1923.

The Prevalence of Phthisis in Different Industries and Means for its Prevention.
E. L. Collis.

The author deals statistically with the effect upon the phthisis death rates of England and Wales of the industrial revolution, the effect of industrial development in different localities, and the effect of specific occupational influences. He concludes that the rise of modern industrialism was associated with a rise in phthisis mortality; that this rise was accompanied by a maximum mortality in early adult life; that social amelioration associated with increased wealth, resulting from industrial prosperity, has been accompanied by a fall in phthisis mortality; that the fall has been accompanied by a move in the age of maximum mortality to late middle age; and that the high mortality experienced by males in industrial districts is a measure of the influence of occupational life.

He applies a method of differential mortality diagnosis to occupations and deduces therefrom the existence of three main factors adversely influencing phthisis mortality —(*a*) opportunities for infection, (*b*) the alcoholic habit, and (*c*) inhalation of silica dust.

He holds that prevention of phthisis mortality is to be sought from (*a*) industrial prosperity; (*b*) avoidance of overcrowding; (*c*) suppression of dust; and (*d*) sobriety.

Pulmonary Tuberculosis and Brass Workers.
G. B. Dixon.

This paper is a study of brass workers in Birmingham, who are found to suffer in excess from phthisis and other respiratory diseases. Brass founders also suffer in excess from alcoholism which, together with exposure to metal fumes, may predispose to phthisis. In the case of other brass workers prevention of exposure to dust and improved hygiene of the workshops are demanded.

The Printing Industry.
G. A. Isaacs.

This article is an able contribution from a Trade Union Secretary. Appeal is made to statistics to show that phthisis is unduly prevalent in the industry. The author ascribes this undue mortality to low standard of living, badly ventilated workshops, bad lighting, dirty rooms, dirty habits, and a general low standard of industrial hygiene with no washing facilities, cloakroom accommodation, or meal rooms. Phthisis as a scourge to the industry is, he holds, only to be met by reversing these adverse influences.

Boot and Shoe Workers.
J. D. McCrindle.

A short description is given of the various departments of a boot factory. Then the mortality among boot operatives in Northampton is quoted to justify the acceptedly high incidence of phthisis in the industry. The author ascribes this to the sedentary nature of the occupation. Movements of the body are restricted and there is little encouragement to free circulation and lung expansion. To this he adds local overcrowding. Inadequate ventilation with stagnant air is not unusual and helps in the propagation of the disease. The author advocates improved ventilation based on kata-thermometer observations. Finally he puts in a plea for industrial sanatorium treatment for convalescing operatives.

A long and interesting discussion followed the reading of these papers.—E. L. C.

THE DISPOSAL OF TUBERCULOSIS CASES. *Proc. Transvaal Mine Medical Officers' Assn., Oct., 1922, vol. 2, pp. 1-8.*

REPORT OF THE SUB-COMMITTEE OF THE TRANSVAAL MINE MEDICAL OFFICERS' ASSOCIATION ON TUBERCULOSIS AMONG MINE NATIVES. *Ibid., Nov., 1922, pp. 3-5. Abstr. as follows in Trop. Dis. Bull., Dec., 1923, vol. 20, pp. 990-991.*

Dr. Hertslet communicated figures bearing on the numbers of natives repatriated during three alternate years.

	1916	1918	1920	Total
Tuberculosis of lungs.....	518	747	947	2,212
Tuberculosis and silicosis..	61	97	191	349
Silicosis only.....	101	85	154	340

The increase in numbers he thinks is due to more rigid methods of discovery or perhaps a higher incidence of disease. After discussing the relative hospital admissions, deaths, and repatriations in East Coast and British South African natives, respectively, he gives a summary of the machinery for repatriation of infected cases, and states that the system works pretty well and is, in his opinion, fairly satisfactory.

An interesting table setting forth the cost of compensation in round figures in 1917, 1919 and 1921, is as follows:

	1917		1919		1921	
	No.	Amount £	No.	Amount £	No.	Amount £
Tuberculosis	950	16,000	580	14,300	540	26,000
Tuberculosis and silicosis	230	7,100	80	2,600	30	1,600
Silicosis	40	720	350	15,000	200	13,500
Ante-Primary	—	—	15	540	60	2,000
Total		£23,820		£32,440		£43,100

As the author points out, "this amount forms a rather appalling total and seems to be steadily increasing."

As to what happens to the repatriated tuberculous natives, there is still room for investigation. In 1918, an inquiry carried out for Dr. Watkins-Pitchford on 100 cases is stated to have given results as follows: dead, 26; fit for work, 26; unfit for work, 11; not traced, 37.

It would be interesting to know how long after repatriation the "follow up" was carried out, but this is not here stated. Dr.

Hertslet suggests, as a corrective to ill-advised repatriation, "that the Bureau be authorized to divide all tuberculosis cases into three classes: (*a*) Those likely to be cured by treatment within three or six months; (*b*) those who may live a year or more if sent home; and (*c*) those likely to die within a month or two. These to be dealt with as follows: The first class to be retained for treatment. The second class to be sent home. The third class detained until their funeral."

Where the Bureau is to discover diagnosable cases of tuberculosis that can be cured by treatment within three months is a problem that puzzles the reviewer, but the point passed without comment in the discussion that followed. Dr. Hertslet recommended that sanatoria and hospitals should be organized for the reception and the treatment of those not fit for repatriation. The whole matter, together with certain minor points that arose during the discussion, was referred to a subcommittee to report to the next meeting or as soon thereafter as possible.

At the next meeting, which was held on November 14, 1922, the subcommittee presented its report, a very important document, which should be of decided value in standardizing the work of medical men recruiting for the mines. It would appear from this report that tuberculosis is already widely prevalent in the native territories and that, in many localities, it is slowly increasing in prevalence. With regard to disposal of cases, it is recommended that a permanent record be kept of all tuberculous natives and that they be classified and recorded by mine medical officers under the headings of "Incipient," "Moderately Advanced," and "Far Advanced," these headings being defined. The subcommittee does not consider it advisable at present to recommend the institution of sanatoria or hospitals for natives, treatment being preferably left to existing provincial or private hospitals in native territories, assisted by government grants. To guide and standardize the work of recruiting medical officers and others, the subcommittee sets forth, in a valuable schedule, the defects that should lead to rejection of applicants for employment on the mines.

Those defects that have a direct bearing on tuberculosis are as follows:

"(1) Weak Chest.—Under this head are included all natives who show signs suggestive of even early tuberculosis or silicosis; natives showing signs of pleurisy, whether acute or chronic; chronic bronchitis, asthma, or any other lung condition which, in the opinion of the medical officer, might operate as a predisposing factor to tuberculosis. It is very important that the natives shall have good expansion, and that the lungs be clear to auscultation. If the first examination leaves any doubt in regard to the last fact, boys should be set aside for subsequent re-examination as instructed by recent circular.

"Note.—Natives who have râles in a circumscribed area, particularly if these are crepitant and are associated with impairment of resonance, should be rejected as being probably tubercular. Crepitations at the bases or in the nipple areas are frequent causes of rejections on the Rand, and particular attention should therefore be paid to these.

"Natives known to have been repatriated as tubercular or as having silicosis should under no circumstances be sent to the Rand.

* * * * * * * *

"(7) Flabby muscles and loose skin showing recent wasting.

"Note.—It has been the experience that the majority of such natives develop tuberculosis and it is useless to send such men to the mines as they will invariably be rejected by the mine medical officers. But when flabbiness and loose skin are due to underfeeding, improvement may be obtained in some weeks, and therefore re-examination is suggested.

"(8) Defective development.—Long, thin, young natives, whose chests and arms are not developed in proportion to the legs, also those who weigh less than 105 lbs., unless under 5 ft. in height."

The subcommittee are to be congratulated on a well-considered "Schedule of Defects." To the outsider it is rather surprising to find that sanatoria and hospitals are considered inadvisable. There must be local circumstances of a peculiar nature behind what appears at first sight difficult to understand.

FINAL REPORT OF THE TUBERCULOSIS SUB-COMMITTEE. *Abstr. as follows from Proc. Transvaal Mine Medical Officers' Assn., Jan.-Feb., 1923, vol. 2, pp. 2-7, in Trop. Dis. Bull., Dec., 1923, vol. 20, pp. 991-993.*

The subcommittee consisted of the follow-

ng: Dr. A. J. Orenstein (Chairman), Drs. S. Donaldson, L. G. Irvine, A. Dodds, and A. L. Girdwood. Dr. P. Allen, Tuberculosis Officer to the Union Health Department, was present by invitation.

Prevalence of Tuberculosis among the Natives.—The data before the committee were insufficient to permit of definite conclusions, but it was thought safe to state that tuberculosis is widely scattered in the native territories and that, in many localities, it is slowly increasing in prevalence.

Initial Examination of Natives in the Territories.—The measures now in use are broadly indicated and the committee does not feel justified in recommending the establishment of a central bureau for the examination of recruits. An amended memorandum on examination of recruits, for the guidance of practitioners in the territories, mine medical officers and the medical men examining voluntary natives and recruits of the Witwatersrand Native Labour Association, is included as an annexure to the report. This annexure may here be considered. It is couched in very general terms and is, on the whole, a good summary of how to examine native recruits. It is not, however, confined to the detection of tuberculosis but deals with all defects which are considered definite causes for rejection of applicants for employment on the mines. The first disability is Weak Chest, defined in the preceding abstract.

A curious note under valvular lesions of the heart is to the effect that natives with tachycardia alone may be accepted. In view of the frequent association of tachycardia with early tuberculosis, this note seems unfortunate. A very wise exclusion is that under "Flabby muscles and loose skin showing recent wasting." There is no better danger signal than these defects in muscle and skin tone in tuberculous natives. Due importance is given to defective development in the advice that all who weigh under 105 pounds be rejected unless at the same time they are less than 5 feet in height. Tubercular glands in the neck are mentioned as a cause for rejection; but there is no mention of tubercular glands elsewhere, nor is it pointed out that all glandular enlargement should be regarded with suspicion as probably tubercular if not otherwise explicable. No reference is made to the significance of enlargement of the subclavicular glands, Borrel's glands, regarded by French colonial doctors as of such importance. It is probable that these recommendations, well applied by skilled and careful men, will serve to pick out a fairly high proportion of the infected natives, but it is, in our opinion, axiomatic that no really successful "tuberculosis filter" can be devised that does not include a short period of observation and the systematic recording of temperatures. If such a period could be arranged for, and if not only temperatures but tuberculin cuti-reactions were recorded, not only would the mines be saved much expense in defective labor and repatriation but South Africa would soon make an accurate contribution to the epidemiology of tuberculosis comparable to that provided by the French colonial records collected under the inspiration of Calmette and Borrel.

Steps Taken for the Timely Detection of Tuberculosis among Mine Native Employees and Recommendations in Regard Thereto.—The existing arrangements include periodic weighing, the examination of the lungs of all natives admitted to a hospital for any cause, periodic inspection, and the examination of all natives who receive an unusually large number of "loafer's tickets," *i.e.*, the "sick passes" issued to those suspended from duty but not ill enough for a hospital. The committee recommends that greater care be taken in the weighing, which should be carried out by or under the supervision of a white employee, the latter to bring to the attention of the mine medical officer any native who appears to him to be out of condition. It is further specified that all natives admitted to a hospital for any cause and all who receive an unusually large number of "loafer's tickets," shall be examined for tuberculosis.

Disposal of Tuberculous Natives.—It is recommended that a permanent record be kept of all tuberculous natives and that they be classified under the headings of "Incipient," "Moderately Advanced," and "Far Advanced." These headings, satisfactory in themselves, are defined in the report and, it must be added, very badly defined. It is almost incredible that an attempt at the classification of tuberculosis should omit all reference to temperature, and that the only mention of tubercle bacilli in the sputum is a note that they are usually absent in incipient

cases. It is disheartening to see an attempt designed to afford information about clinical type damned from the start by omission of records of fundamental importance.

The committee thinks that natives, if offered treatment locally, would refuse it, and that it is useless to attempt to retain at the mine area those found likely to die within a month. Further, it is considered inadvisable to recommend at present the institution of hospitals or sanatoria for the treatment of tuberculosis in natives, the accommodations for such cases in existing provincial and private hospitals being regarded as sufficient. We look in vain for any sort of constructive proposal for the disposal of tuberculous natives, and, while admitting that local difficulties may be great, we can only regard with profound disquiet the facile suggestion to permit the return of dying cases to their kraals and the treatment of advanced phthisis in the wards of general hospitals receiving natives suffering from other diseases.

Anthrax in Various Countries. *Internat. Labour Rev., Dec., 1923, vol. 8, pp. 903-914.*

This article continues a series in which anthrax in Germany and Italy have already been discussed. The information available is not so thorough as for those countries. In Denmark the disease is not of much industrial importance since thirty-seven out of forty-four cases which occurred from 1909 to 1918 were butchers. Notification of anthrax is not yet compulsory in Sweden, although the disease is considered an industrial accident when occurring in occupations; no information is available as to its occurrence in industry. In the Netherlands the leather industry provides a certain small number of cases among tanners, about four every year; the hair and bristle industry is less consistent, as sixteen cases among brush makers occurred in 1912, but only one in 1920. In Austria previous to the war, industrial anthrax was recognized in the skin industry, but more particularly in handling hair: thus, fifty cases were reported in a single hair-spinning factory from 1897 to 1907. Statistical information is also given regarding the occurrence of anthrax in Poland and Roumania; but throughout the article the information as to the occurrence of the disease among animals seems more reliable than the information as to its industrial importance.—E. L. C.

Hookworm Infestation in Coal Mines of Bengal. *J. W. Tomb. Abstr. as follows from Indian Med. Gaz., Oct., 1923, vol. 58, p. 473, in Jour. Am. Med. Assn., Jan. 5, 1924, vol. 82, p. 65.*

Tomb says that hookworm infection is found among the majority (70 per cent.) of the workers in the coal mines of Bengal without any apparent symptoms.—K. R. D.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

The Occupation Dermatoses of the Paraffin Worker of the Scottish Shale Oil Industry. *A. Scott. Eighth Scientific Report of the Imperial Cancer Research Fund, 1923, pp. 85-138.*

This monograph is based upon twenty-four years of personal experience among these workers. It is illustrated by a number of sketches and sixty-two plates. It particularly reflects the conditions disclosed by the three-monthly medical examinations, instituted during the last four years, of the 200 men employed in the paraffin departments of the Scottish shale oil industry. Typical cutaneous lesions appear in at least 50 per cent. of the operatives and persist to a greater or less degree during exposure to the oils. The less chronic types disappear in a short time when work with paraffin is given up.

Dr. Scott classifies the lesions that he has observed under the following heads: occupation comedones, folliculitis, dermatitis papularis, erythema simplex, dermatitis erythematosa, and epithelioma. The first type is caused by a filling up of the sebaceous ducts with semi-solid paraffin materials, or the obstruction of their orifices by a thickening of the superficial layers of the epidermis. In the second type, destruction of the hairs and hair follicles by a very mild inflammatory reaction set up by the shale oils occurs. The lesions appear as closely-grouped clusters of black points over the areas affected. They never suppurate, and they tend to remain

indefinitely. A third type, not very common, is the superficial pustule surrounded by a red areola. It usually forms round the shaft of the hair on any exposed part of the body, especially in young subjects. A papular eruption, however, is the most frequent, as well as the most characteristic, feature of this occupation, being present in between 40 and 50 per cent. of paraffin workers. It begins as a small, reddish, rounded elevation which attains the size of a pepper corn or a small pea. Generally each lesion very slowly necroses and leaves a scar. In cases of long standing, these papules, instead of healing, assume a warty change and, gradually becoming harder and harder, constitute permanent stigmata of the shale oil workers' trade. In the older workers, that is, workers over 40 years of age, who have given long service, they form the precancerous growths.

The erythema seen in these workers is invariably general, not patchy. It begins as a slight hyperemic blush, which later deepens and becomes bluish. The superficial vessels in time become continuously dilated and remain a distinct feature. The color does not fade from the skin by pressure, but gradually takes on a darker shade of pigmentation. The cutaneous surface is at first rough, dry, and scaly; later it may become glossy and smooth. All these symptoms indicate a low type of inflammatory change, which produces what Dr. Scott calls "dermatitis erythematosa," in which we get increased and fixed pigmentation and thickening, with, or without, in some places, atrophic white patches. At this period small, flat, scaly, oval, or round warts make their appearance. In all the chronic, or permanent varieties of paraffin dermatosis, such as the warty stage, Scott has noticed that the tendency toward epithelial hyperplasia may continue long after all exposure to the oil has ceased. The epitheliomata are invariably single—that is, not more than one is seen at the same time on the same individual. In the beginning, their malignancy is not great. They rarely occur before middle age, or until the employee has been engaged in the work more than twenty years. The usual sites are the back of the hands, the lower third of the forearm, and the scrotum. Cancers start only from the warts or other chronic indurations. Though some of the different kinds of dermatoses develop practically in every person who is constantly handling shale oil, Dr. Scott's experience shows that malignant tumors are more frequent among the stillmen, retort-men, and laborers who only occasionally handle these materials (a point worthy of further elucidation). The general cancer incidence is not high, being approximately under 0.1 per cent. per annum of the workers employed.

The protection of these men is best obtained by providing adequate facilities for insuring absolute cleanliness of the body and clothing; by smearing all exposed surfaces of the skin with semi-crude, thick castor oil; and by regular medical inspection every three months.—R. P. W.

A Case of Nickel Itch. *Girard and S. Trévenard. Bull. Soc. méd. d. hôp., Nov. 29, 1923, pp. 1642-1644.*

A man whose duty it was to dip and remove objects from an "electric nickel plating bath" suffered much from irritation of the fingers, forearms, and arms, and occasionally from a few scattered lesions on the thighs and feet. The trouble began with severe itching, which lasted a week before the eruption appeared. This showed itself by a brief redness, soon followed by a number of superficial discrete ulcerations. Neither induration nor redness surrounded the sores, which were most numerous on the fingers. They discharged a little pus and became crusted over with a brown scab, under which a fine cicatrix formed. The man suffered from mild symptoms of constitutional nickel poisoning.

The liquor in the bath was green, very acid, and contained the double salt of sulphate of nickel and ammonium. The writers are of opinion that the lesions were due, not to the double salt, but to the high concentration of free sulphuric acid present in the bath.—R. P. W.

Toxic Amblyopia. *G. de Andrade. Abstr. as follows from Brazil-Medico, Sept. 8, 1923, vol. 2, p. 153, in Jour. Am. Med. Assn., Jan. 12, 1924, vol. 82, p. 166.*

De Andrade discusses the group of toxic amblyopias with central scotoma and inability to distinguish colors. This is the tobacco and alcohol, arsenic, carbon bisulphide, iodoform and diabetes group. The visual disturbance develops insidiously, and persons in this category whose occupation requires distinguishing between red and green may make

disastrous mistakes before their amblyopia is recognized. He reports some puzzling cases; one in a woman who had clandestinely taken up smoking in prophylaxis of influenza. Two other cases were in men who used neither tobacco nor alcohol, but one was bookkeeper in a dark, close room in a tobacco factory where the air was saturated with tobacco fumes, and the other worked with carbon bisulphide. Examination of this young man's working mates showed similar visual disturbances in three others. The proprietor of the factory installed better ventilation, and there have been no further cases. In all the cases in this category, abstention, with the indicated therapeutics, was followed by a complete cure. One patient was unwilling to change his habits, and the visual disturbances progressed to complete blindness.—K. R. D.

A Note on Boiler-Makers' Deafness. *R. Lake. Abstr. as follows from Jour. Laryngology and Otology, June, 1923, vol. 38, p. 323, in Med. Jour. Australia, Oct. 6, 1923, vol. 2, p. 367.*

Boiler-makers working for long periods in an appalling din, with insufficient intervals of rest for the tired auditory organ to recover, frequently become deaf, though they can usually hear comparatively well in the clash and crash of the shops. In these individuals the ability to hear voice and whisper is much diminished. Rinné test with c (128 d. v.) yields a positive result and bone conduction is reduced to one-third or less than normal—a totally different picture from that of progressive middle-ear deafness or otosclerosis. Probably the end organ of the auditory nerve is first irritated by the excessive noise and then gradually injured, eventually beyond repair. The author suggests that workers in noisy metal workers' shops should wear sound deadeners. He prefers "Aurotectors" for the purpose.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

Methods of Statistics of Industrial Accidents. *Internat. Labour Office, Studies and Reports, Series N, No. 3, Dec., 1923, p. 63.*

Accident Prevention and Health Service in Industry. *M. R. Lott. Nation's Health, Dec., 1923, vol. 5, pp. 884-886.*

In 1917 the lost-time accidents of the Sperry Gyroscope Company reached the peak of forty-five lost-time cases to 1,000 employees per month. The accident conditions appeared so unnecessary to the management that a safety engineer was appointed. A plant hospital was established and the services of a nurse and physician were secured. These innovations were immediately attended by a fall in lost-time cases to two per 1,000 employees per month. Too much cannot be said concerning the importance of suitable personality in the persons who render this service. The system by which the above significant results were obtained is herein briefly stated.—L. A. S.

Safety and Protection in Industry. *J. A. A. Pickard. Internat. Labour Office, Studies and Reports, Series F, No. 9, Dec., 1923, pp. 7-18.*

The writer points to the economic position caused by accident compensation. Employers appear to pay £100 in premiums for every £48 paid out in benefits to injured workers; legal, medical, and other charges take the rest. One out of every ten miners is disabled for over a week in each year; other industries have relatively high figures, while a host of minor accidents lasting for less than a week are excluded from the records. Nevertheless, in 1921, £5,500,000 were paid in England and Wales in compensation. Really the total cost to industry of accidents is far higher than this figure, for compensation payments are usually supplemented from accident funds administered by workers' organizations. Prevention is better than compensation and could be effected by the expenditure of less money. The preponderance of the human element in accident causation is dealt with, and the conclusion arrived at is that accident prevention is largely a psychological problem to be treated by education. A plea is put forward for agreeing upon some standard of frequency rate and of severity rate so that statistics of accidents may be comparable. The number of lost-time accidents per million hours worked is suggested for the frequency rate and the

number of days lost per thousand hours worked for the severity rate. Safety first should have its place in the organization of every industrial concern. The costs are inconsiderable when 20 to 80 per cent. of the accident toll can rapidly be saved. The movement is a national humanitarian one aimed at lessening one of the heaviest burdens imposed upon civilization.—E. L. C.

THE SAFEGUARDING OF INDUSTRIAL MACHINERY. *G. S. Taylor. Internat. Labour Office, Studies and Reports, Series F, No. 9, Dec., 1923, pp. 19-33.*

This article deals with the principles underlying the safeguarding of machinery. The author shows how in Great Britain legislation has developed to attain this end, and how it has been and is being based upon detailed analyses of accidents which are notified to the expert inspectorial staff at the Home Office. The essentials of a satisfactory safeguard are: it should prevent access to the danger point; it should be constructed of materials calculated to withstand wear and tear; it should form an integral part of the machine; it should be automatic in action; its removal should not be necessary for the purposes of lubrication; it should not introduce a new risk of its own; it should not interfere with the output of the machine. These principles are applied to the guarding of shafting, projecting parts, flywheels, driving belts, spur and friction gearing.

The safeguarding of machinery may be secured in the following ways: through inspection; through education by explanatory pamphlets; through conferences and agreements; through education of employers, foremen and operatives; and, finally, through national and international co-operation. All machinery should be sent out by the makers with danger parts guarded, but until there is international agreement as to the guards required, the makers will pay little attention to this point. For this purpose experience gained in various countries should be collated.—E. L. C.

PUNCH PRESS GUARDING IN A JOBBING SHOP. *H. R. Sinclair. Nat. Safety News, Dec., 1923, vol. 8, pp. 16-17.*

The safety devices used by the Worcester Stamped Metal Company are (1) pull guards, (2) one-hand trips combined with pliers or implements, (3) chutes combined with implements, and (4) pliers or implements. Sometimes two devices are combined.

A daily record of the safety devices in use is kept to place responsibility and to check the effectiveness of the various methods of guarding machinery. This consists of a suitable list of the machinery arranged in groups corresponding to the control of the press foreman. An actual record of the device in use at the minute of operation is taken, the sheet being a bird's-eye view of the condition of the machines as regards safety. If any accident occurs, examination of the record shows where tendency to slackness has developed. The fact that every operator and every foreman knows that this record is taken is a strong inducement to use safety methods.—M. F. M.

INDUSTRIAL ACCIDENTS IN THE CALIFORNIA OIL FIELDS. *H. C. Miller. U. S. Bur. Mines, Rep. Investigations, Serial No. 2557, pp. 22.*

This report is the first of a series of papers on oil-field accidents. It analyzes more than 4,000 accidents among the oil-field employees of ten representative California oil companies during the years 1921 and 1922. The tables presented show the cause and frequency of these accidents, the part of the workman's body affected, the time in days lost, and the occupation of the injured employee.

The total number of accidents causing disability lasting longer than the day of injury was 4,108—approximately two-thirds of all the lost-time accidents in the oil fields of California in 1921 and 1922.

Accidents caused by the machinery at drilling and producing wells amounted to 14.17 per cent. of the total and were responsible for 29.38 per cent. of the lost time. As a source of accidents, heavy lifting and straining closely follows the machinery at drilling and producing wells, though falls caused the loss of more than four times as many days, largely because of the serious character of falls from derricks and derrick ladders.

Accidents to drilling crews numbered 39.34 per cent. of the total and caused 54.27 per cent. of the time lost through injuries. In terms of days lost, accidents to pumpers and oilers rank second; in numbers, accidents to roustabouts and laborers.

Time lost on account of injuries received in the course of employment averaged, in

1921 and 1922, slightly more than 3 per cent. of the total days worked by the employees in nine out of the ten companies investigated. If we assume a conservative average wage of $7 a day for oil workers, the time lost represents a gross loss of nearly $1,000,000 to the oil industry. This does not include the amount lost through the disorganizing effect which accidents have on the workers.—M. F. M.

SOME NOTES ON THE TRAINING OF MEN FOR RESCUE TEAMS. *A. P. Veale. Tr. Inst. Min. Eng., vol. 65, part 4, pp. 200-208.*

All rescue men must have had experience in work done at or about the coal face, but it is advisable to include a first-rate mechanic in at least one team at each colliery. The captain of the team should be a deputy or an overman; the other members should preferably be road repairers. The men should be from 25 to 45 years of age; they must have self control and be of temperate habits and used to strenuous work. Medical examination is necessary at the commencement of the training and at intervals of twelve months. In Great Britain a physical test is also carried out by the superintendent of the rescue station. The best test is to use a Martin ergometer for fifteen minutes at the rate of 5,000 foot-pounds per minute. Normal conditions of pulse and respiration should be regained in from fifteen to twenty minutes. A candidate showing any of the following complaints should be deemed unsuitable: varicose veins, hernia, flatfoot, epileptic fits, skin disease, facial deformation, or rheumatic fever.

Full details are given of the twelve practices recommended, four of which should be held underground. The training is best carried out at a central rescue station and each team should have seven men to allow the practice to be carried on in case of illness of one or more of the team.—T. L. L.

INDUSTRIAL SURGERY

SURGICAL THERAPEUTICS. *A. M. Dickinson. Indust. Doctor, Jan., 1924, vol. 2, p. 13.*

In this short paper Dr. Dickinson emphasizes four important factors in the treatment of fractures. These are (*a*) early reduction and immobilization; (*b*) early mobilization; (*c*) use of physiotherapy; and (*d*) frequent X-ray examination. Among the more important specific measures recommended are the early application of casts, baking and massage, and the use of the fluoroscopic screen during reduction.—H. B. E.

THE TOXEMIA OF SEVERE SUPERFICIAL BURNS. *B. Robertson and G. L. Boyd. Jour. Lab. and Clin. Med., Oct., 1923, vol. 9, pp. 1-16.*

The authors conclude this article as follows:

1. Death from burning occurring within the first twenty-four hours is practically always due to primary shock: later than this, it is due to toxic shock.

2. There is a toxin produced in burned tissue, in larger quantities in skin burns, which circulates in the blood, either in, or adsorbed by, the red blood corpuscles, and which causes the symptoms seen in bad superficial burns, and in some cases death.

3. Extracts of burned skin are toxic. Extracts of skin burned postmortem are innocuous.

4. There is increased protein catabolism in burns as evidenced by the increase in non-protein nitrogen and urea nitrogen of the blood.

5. The contents of burn blisters are not toxic.

6. Whole citrated blood from burn cases is toxic. The blood serum is not toxic. Solutions of the corpuscles properly treated are more toxic than whole blood.

7. The toxic substance consists of two portions, one of which is thermostabile, diffusible and neurotoxic; the other is thermolabile, colloidal and necrotoxic. Chemically the toxin consists of primary and secondary proteoses.

8. No evidence of the production of antibodies against the burn toxin could be found.

ABSTRACT OF THE LITERATURE
OF
INDUSTRIAL HYGIENE

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DUST HAZARDS AND THEIR EFFECTS

DETERMINING THE EFFICIENCY OF AIR CLEANERS. *A. M. Goodloe. Jour. Am. Soc. Heating and Ventil. Eng., Feb., 1924, vol. 30, pp. 115-119.*

A method of artificially producing dust clouds is described and a brief account is given of new apparatus for determining dust in air. The device is called a "viscous impinger." It consists of an air intake tube to which is attached a 5/32 inch glass spiral with a bulb similar to an entrainment separator blown on the distal end of the spiral. The bulb serves to reduce the air velocity. The inside of the bulb is coated with vaseline and the impingement action takes place in the bulb. The apparatus, which weighs about 25 gm., is weighed before and after determinations, and the increase in weight gives the dust caught. Air is passed through at a measured rate of about 0.5 cubic foot per minute.

The efficiency of the device was determined by connecting a filter flask to the escape end and bubbling the escape air through water. Caustic soda powder from the dust liberator was passed through the impinger and through the bubbler which contained phenolphthalein. Using prussian blue powder and the color produced in the bubbler as an index of the efficiency of the viscous impinger, the performance was said to be satisfactory. A further test was made by impinging the escape (without the bubbler) on a vaselined slide.—P. D.

THE PRODUCTION AND MEASUREMENT OF AIR DUSTINESS. *M. Ingels. Jour. Am. Soc. Heating and Ventil. Eng., Feb., 1924, vol. 30, pp. 135-151.*

The "dust liberator" consists of a small motor-driven bucket elevator, the buckets of which are filled from and emptied into the same chamber. Constant pressure is applied by a small blower, and a stream of air and

dust is thereby blown out into the test room.

The use of the Anderson-Armspach Dust Determinator is discussed at length and comparative tests with a number of determinators are described.

In previous chapters (see THIS JOUR., 1923-24, vol. 5, Abstr. Section, p. 54) the author has shown the need of knowing the initial pressure drop across the resistance medium used in dust determinations with this apparatus. In the present paper a series of curves shows that results with low individual variations may be obtained from a series of determinators, the individual filters of which vary in initial resistance. By referring to these curves, dust determinations may be made quickly and with sufficient accuracy for the purpose intended.

Because of the numerous charts and tabulated data, reference must be made to the original paper for details.—P. D.

THE LOWER LIMITS OF CONCENTRATION FOR EXPLOSION OF DUSTS IN AIR. *L. J. Trostel and H. W. Frevert. Chem. and Metall. Engin., Jan. 28, 1924, vol. 30, pp. 141-146.*

The work of previous investigators is reviewed and their discordant results are explained as being due, at least in part, to dissimilarity in materials but more especially to the fact that their determinations were frequently made without adequate control of the amount of material in actual suspension in the air.

A modified Clement-Frazer explosion bomb is described in detail, and is sketched. It includes an air (instead of oxygen) jet tube for insuring uniform air suspensions of the dusts and three interchangeable ignition devices—*viz.*, (1) glower ignition, (2) arc ignition, and (3) induction coil ignition. A connection for recording gas pressures is used with the apparatus and the size of the flames produced is also measured.

It is pointed out that such dusts as finely powdered aluminium (200 mesh) on ignition generate relatively enormous quantities of heat and no gaseous products as compared with carbonaceous dusts, such as sugar or starch, of equal particle fineness, and that this high temperature of reaction facilitates the propagation of the explosion if more aluminium powder is liberated into the air. Furthermore, the high temperature expands the air (in the vessel or explosion chamber) with an explosive violence.

A series of curves and tables gives the lower explosive limits for starch, corn elevator dust, wheat elevator dust, sulphur, sugar, aluminium, and "standard Pittsburgh coal" by the three explosion bomb methods. —P. D.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

SPOROTRICHOSIS. *H. R. Foerster. Am Jour. Med. Sciences, Jan., 1924, vol. 167, pp. 54-75.*

The author concludes his article as follows:

In reviewing the histories of reported cases of sporotrichosis, one is impressed by the great frequency with which this disease is erroneously diagnosed and apparently not even suspected for weeks, months and sometimes years. During all this time the patient is partially or wholly incapacitated for work and subjected to medical and surgical attention that does not benefit him. The glaring deficiencies of diagnostic effort as disclosed by the records are irrefutable evidences in support of the view that numerous cases of sporotrichosis are never recognized. The frequency with which sporotrichosis develops following injury while at work, its occurrence chiefly among the wage-earning class of individuals, especially those in certain vocations, and the predilection of the disease for the hands and forearms among manual workers are, I believe, arguments justifying its consideration among the groups of occupational diseases. The ever-widening scope of industrial and social medicine, enhanced by the introduction of special legislation in many states, increases the importance of such diseases. In four of my cases, employees of a tree nursery, settlement for compensation claims rested upon a recognition of the disease and its mode of contraction.

The evidence at hand indicates that sporotrichosis is a disease of considerable prevalence and of world-wide distribution with a tendency to endemic occurrence in certain

localities where the frequency of its recognition appears to vary directly with the alertness of the medical profession to the possibilities of its presence. It is also evident that sporotrichosis is of considerable economic importance, and the rapidity and ease of cure under appropriate management, as contrasted with the otherwise prolonged period of disability and medical supervision, make it incumbent upon the practising physician and surgeon to acquaint himself with the various manifestations of this disease.

SPIROCHAETO-IS ICTEROHAEMORRHAGICA IN EAST LOTHIAN. *G. L. Gulland and G. Buchanan. Brit. Med. Jour., Feb. 23, 1924, pp. 313-314.*

This rat-borne disease is practically unknown in the British Isles. Its occurrence and recognition in two Scottish coal mines has, therefore, special interest. Possibly the rats became infected from some miner returning to work after becoming infected while in the army in France, where the disease occurred in the trenches. Some twelve to eighteen miners are known to have been affected, and deaths are reported. The spirochetes were detected in rats from the mines and also in the urine from patients which, when injected into guinea-pigs, caused hemorrhagic jaundice. The spirochetes were found in the livers of these animals.

The article is illustrated and is preliminary to a fuller description.—E. L. C.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

ADJUVANTS TO MAGNET POINTS FOR EXTRACTION OF FOREIGN BODIES FROM ANTERIOR CHAMBER AND IRIS. *B. Chance. Am. Jour. Ophth., Jan., 1294, vol. 7, pp. 44-45.*

Sometimes small chips lodging on the iris or in the angle of the anterior chamber are troublesome to withdraw either because their positions necessitate surgical traumatism or because it is difficult to approximate the magnet point to the spicule. Chance reports two such cases in which he succeeded in removing the foreign body without further damage to the eye.

In the first case a small jagged piece of steel had lodged in a furrow of the iris, at the angle of the lower chord of the chamber. The wound of entrance had healed when the patient applied for treatment. The author was able to dislodge the body with the giant magnet but could not force it to penetrate the cornea. His attempts to seize the body with iris forceps inserted through a corneal opening were unsuccessful, and none of the magnet points was small enough to enter the opening. He therefore cautiously inserted an iris spatula until the point reached the foreign body. To the tip of the handle of the spatula the Parker magnet with a blunt point was applied. In this way the piece of steel was withdrawn without the slightest traumatism. The eye promptly recovered.

In the second case the foreign body was lodged in the iris tissue, in the upper nasal quadrant, and it was impossible to apply the magnet so close to the bridge of the nose. After making a corneal incision, the author inserted a closed curved beaked iris forceps until the points touched the spicule and then applied the magnet to the joint of the forceps. The body was safely extracted without any damage resulting.—M. C. S.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

MEMORANDUM ON ACCIDENT PREVENTION. *Industrial Welfare Society, London, 1924.*

This publication is a useful summary of modern methods for preventing accidents in industry. After a consideration of the economic advantages to be gained, methods of procedure are discussed under the headings of discipline, education and mechanical guards, which are considered of value in the order named. The establishment of general safety committees and departmental committees of the workers is recommended, and the duties to be undertaken by such committees are explained in detail. The advantage of "no accident" competitions and the way in which they may be organized are set forth.

The value of posters and of accident records is shown by examples. The number of man-hours worked and the number of days lost are suggested as the denominators upon which accident frequency rates and severity rates, respectively, should be calculated. The importance of first aid in lessening severity rates is stressed. The pamphlet contains a useful series of sample record cards and typical posters.—E. L. C.

Safety Work in Continuation Schools and Industrial Plants. *C. Van Horn. Safety Engin., Jan., 1924, vol. 47, pp. 47-50.*

Safety work should be particularly emphasized in continuation schools since in most cases the boys will eventually engage in industrial work. Lectures on safety may be based on the theme of patriotism or obedience.

In industrial plants, the most important man to be impressed with the value of safety methods is the foreman, because he is in direct contact with the men and is better able to encourage their efforts to prevent accidents.—R. M. C.

An Effective Sewing-Machine Guard. *Travelers Standard, Jan., 1924, vol. 12, pp. 10-11.*

A device for protecting the line shaft drive for power-driven sewing machines consists of three parts: (1) a horizontal tubular guard that completely surrounds the drive shaft, from end to end; (2) a vertical, box-like guard that completely incloses the transmission clutch and driving belt; and (3) an upper belt-guard that protects the upper hand-wheel and prevents the operator, or the material, from becoming caught in the moving belt.—R. M. C.

How Plumbers Get Hurt. *Travelers Standard, Feb., 1924, vol. 12, pp. 25-35.*

The majority of accidents to plumbers are caused by hand tools, minor appliances, and unsafe practices on the part of the men. All tools should be kept in good condition and should be used properly. Thoughtlessness in the use of the soldering-iron and blow-torches, carelessness in the piling of pipes and other cylindrical things, and testing for gas leaks with candles or lighted matches are frequently the cause of serious accidents. Many accidents have been due to tightening nuts or calking leaks when the pipes and fittings were under pressure. It is recommended that every plumber carry in his tool kit a simple first-aid outfit containing suitable antiseptics for treating small injuries and sterilized cloth or gauze for bandages.

Static Hazards in Gasoline Handling. *C. L. Naylor and H. E. Ramsey. Nat. Safety News, Feb., 1924, vol. 9, pp. 13-15.*

A serious static charge can exist even with all metal parts and containers grounded, and in pouring or loading inflammable liquids in bulk, it is not necessarily enough to ground pipes, hose, tanks, etc. Complete safety may require a conducting pipe that extends practically to the bottom of the receiving tank or vessel. In the case of the filling hose at a gasoline service station, the nozzle should be placed in contact with the gasoline tank before starting the flow, and should be held there until the flow has ceased. In loading or unloading gasoline tank trucks, both the vehicle and the receiving tank should be grounded.—R. M. C.

A Locomotive-Crane Hazard. *Travelers Standard, Jan., 1924, vol. 12, pp. 7-10.*

A running board at the end of a locomotive crane is a safer arrangement than the old-style stirrup steps and hand-holds at the sides. Men are, however, to be discouraged from riding on the cranes as the element of danger is always present.—R. M. C.

Safety Pantomime Wins in Harvester Contest. *Nat. Safety News, Jan., 1924, vol. 9, p. 41.*

A safety pantomime entitled "Actions Speak Louder than Words" was produced recently by the Deering Twine Mill employees. The first scene shows Carelessness going through a factory tempting workers to take all kinds of chances, but each time the figure of Harm appears to warn the worker, who finally chases Carelessness off the stage. The second scene shows a Works Council room with a Safety Committee in session. Carelessness tries unsuccessfully to interrupt them.

The complete scenario for this pantomime is on file with the National Safety Council and is available for the use of those who are looking for ideas in producing similar stunts.—M. F. M.

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

THE STUDY OF INDUSTRIAL FATIGUE. *D. R. Wilson. Internat. Labour Office, Studies and Reports, Series F, No. 9, Dec., 1923, pp. 35-48.*

The writer, who is Secretary of the British Industrial Fatigue Research Board, outlines the historical inception of the work of his Board and points to the difficulty experienced in ascertaining existing knowledge on industrial fatigue. The work already done has established the importance of the human machine. In humid cotton weaving, although the thread improves with a rise in temperature, when the wet bulb rises above 73° F. an actual diminution of output occurs, because the conditions are adverse physiologically to the weaver. Even a good system of artificial light gives 10 per cent. less efficiency than natural lighting—a fact established by more than one investigator—while better illumination in coal mining increases the output by nearly 15 per cent.

The Fatigue Board really concerns itself with the workers' fitness, bodily and mental, resulting from favorable conditions of work. Knowledge drawn from every branch of industry at home and abroad is required to throw light upon the problems arising, but at present there is no co-ordinating center. Telegraphists' cramp occurs in English post office workers, but is said to be unknown in France. Why? Other instances of the need for national comparisons might be quoted. International action is required to facilitate the collection and examination of investigations already made; to discover valuable data already in existence; to co-ordinate the work of existing organizations; to short-circuit investigations through elimination of non-operative factors; and to provide increased facilities for the study of extreme types and conditions. Knowledge must first be attained; then joint publication and special inquiry are required. An example of joint publication exists in the Journal of Industrial Hygiene which contains accounts of investigations conducted in England and America. Special inquiry is needed by experts sent from country to country to study conditions on the spot. Co-operation on international lines would result in the industries of one country benefiting and being benefited by the experience of industries in all others.—E. L. C.

INDUSTRIAL ASPECTS OF HUMAN FATIGUE. *F. B. Flinn. Jour. Personnel Res., Nov., 1923, vol. 2, pp. 285-293.*

This article is a review of the present status of industrial fatigue studies "based on investigations conducted during the past few years by Dr. Flinn for the Public Health Service in a number of industrial establishments and in the laboratories of the College of Physicians and Surgeons at Columbia University."

The author discusses fatigue from its medical and physiological aspects, and attempts to define the nature of fatigue. He differentiates sharply between objective and subjective fatigue and believes that "the only reliable measure of fatigue on the objective side is output." He describes historically the different physiological theories of fatigue.

There are a few illuminating paragraphs on fatigue and adaptation. The author believes with Rowntree that certain kinds of work require certain types of individuals. Some jobs need the big, phlegmatic type while others need the thin, nervous individual. He mentions Rowntree's use of the expression "mental-motor ratio," which is defined as the ratio between innate intelligence and control of the neuromuscular mechanism.

In the most valuable part of the paper he discusses the contingent causes of fatigue and recognizes among these individual differences in constitution and habits, working conditions, particularly ventilation, illumination, and temperature, and factors outside of the factory, such as insufficient sleep, inadequate, hurried breakfast, etc. He mentions an experiment in a certain plant where, upon the advice of a physician, the company furnished breakfasts to its employees after their arrival—a plan which resulted in an improvement in the physical condition of the girl employees and also a marked increase in production.

It is gratifying to note that the author places considerable importance on the prominence of mental mechanisms in the genesis of fatigue.—H. B. E.

A Comparison of Different Shift Systems in the Glass Trade. *E. Farmer. Indust. Fatigue Res. Board, Rep. No. 24, 1924, pp. 24.*

The Industrial Fatigue Research Board has just issued, in conjunction with the Glass Research Association, a report dealing with the relative efficiency of different shift systems in the glass trade. Apart from its content, this report has a special interest inasmuch as it is the first occasion on which an outside industrial organization has contributed to the expense of an investigation by the Board. This fact is significant of the growing interest taken in the Board's work by those who are responsible for the organization of industry, and it is to be hoped that other organizations will follow the lead set by the Glass Research Association. This co-operation is most important because it insures that the Board's reports shall not only be of scientific value but shall also deal with problems of real practical interest to industry.

A recent change in the glass trade from a ten-hour to an eight-hour shift offered an opportunity for examining its effects on output. A large number of firms placed their records at the disposal of the investigators who compared the output of individual groups of workers, manufacturing the same article, both before and after the change in the method of dividing the working day. The results showed unmistakably that the average hourly output was greater when the eight-hour shift was worked than during the ten-hour shift. There were only two exceptions to this rule; these occurred in the case of very small bottles, and this, coupled with the fact that the increase in hourly output due to the shortening of the working period tended to be greater with the heavier work than with the lighter, led the investigators to suggest "that heavy muscular work involves a type of fatigue which can be alleviated by shortening the working spell, whereas the fatigue involved in the constant repetition of an intricate operation is not relieved by this method to the same extent. Such a conclusion cannot be regarded as definitely established from the data offered in this report, but it is at least suggestive, and further research along these lines might indicate the most economical working period for various occupations.

The bad effect that high temperature has on output is also pointed out in the report, but this matter has not been fully dealt with, and forms only a subsidiary part of the investigation; still the figures which are given are at least sufficient to show how important atmospheric conditions are in industry and it is much to be hoped that an investigation dealing with this problem alone may be carried out in the glass trade. It is to be regretted that it was not possible to do this in the present investigation, for it would be interesting to see what effect bad atmospheric conditions have on output both in the long and the short shift system.

The report naturally contains a good deal of statistical matter, but it is so arranged that the text can be understood without reference to what are to most people somewhat irritating details, and the numerous diagrams make it easy to follow the general argument. Those who wish to go more fully into the matter will find the whole of the data at their disposal and can work out conclusions for themselves.

Some Common Mountain Ailments and How to Combat Them. *B. Hudson. Lancet, Dec. 22, 1923, vol. 2, pp. 1371-1372.*

As one ascends heights, the barometric pressure and the body temperature fall and the humidity of the air lessens. Owing to the absence of watery vapor, dust, smoke, and micro-organisms, the heat, light, and chemical rays of the sun pass more freely through the atmosphere and act with greater intensity. This radio-activity of the sun is greatest when the winter snows have freshly fallen. Living under such conditions, the red blood cells and hemoglobin require to be increased to compensate for the diminished tension of the oxygen in the air. In the absence of due acclimatization strenuous work at 4,000 to 5,000 feet is accompanied by difficulty and discomfort. Shortness of breath, palpitation, headache, and malaise may be distressing symptoms. Both the healthy and the weak require to be cautioned before proceeding to live and work in the high regions of the earth.

Bad sunburn is not common in Switzerland on the mountains in midwinter. It is, however, a danger to be reckoned with from February on, especially by those unaccustomed

to this exposure. Altitude and new snow are the trying agents. The burns may be very severe and can be accompanied by toxic symptoms and fever. A simple means of prevention is to grease the face and uncovered parts with cocoa butter.—R. P. W.

HAZARDS OF COMPRESSED AIR, DIMINISHED PRESSURE, GENERATION AND USE OF ELECTRICITY, AND ELECTRICAL WELDING

TWO ELECTROCUTION VICTIMS RESUSCITATED AFTER ONE AND THREE HOURS BY ARTIFICIAL RESPIRATION. *S. Jellinek. Wien. klin. Wchnschr., Nov. 22, 1923, vol. 36, pp. 832-834.*

The two cases are cited in detail. Both victims were accidentally electrocuted and collapsed, showing no signs of life. Artificial respiration by the Schäfer method was applied for one and three hours respectively before breathing recommenced. Artificial respiration in such cases should not be abandoned until appearance of lividity of the body shows the task to be hopeless.—B. C.

HEAT, COLD AND HUMIDITY

COOLING EFFECT ON HUMAN BEINGS, PRODUCED BY VARIOUS AIR VELOCITIES. *F. C. Houghten and C. P. Yagloglou. Jour. Am. Soc. Heating and Ventil. Eng., Feb., 1924, vol. 30, pp. 169-184.*

In a previous paper by the authors the "effective temperature" scale was described in detail (see THIS JOUR., 1923-24, vol. 5, Abstr. Section, p. 173). The data for the first paper were based on "still air" as distinguished from moving air. The present paper is concerned entirely with air at varying velocities and with the cooling effect thus produced.

Substantially the same methods of judging conditions were used in these tests as in the former. The same psychrometric equipment was employed and air currents of definite velocities were produced by a bank of fans blowing air through wind tunnels of sheet iron construction in which the subjects stood. By using two entirely independent units the subjects passed from one chamber to the other, as in the former tests, and voted on the effective temperatures of the two tunnels.

In addition to the effective temperature lines plotted on the psychrometric charts of their former paper, the authors have placed another series of lines called the "equivalent effective temperature." In a further series of five charts, they have plotted equivalent effective temperatures with air velocities as abscissas against both effective temperatures and dry bulb temperatures for relative humidities of 20, 40, 60, 80, and 100 per cent. By means of these charts the authors bring out the following points:

"1. The greater the air velocity the more nearly parallel the equivalent effective temperature lines become to the dry bulb temperature lines. In other words as the air velocity increases dry bulb temperature becomes more predominant as an index of comfort. Also the greater the velocity the higher the temperature at which the equivalent effective temperature lines become vertical, in which case comfort is independent of wet bulb temperature.

"2. At ordinary temperatures the higher the relative humidity for a given dry bulb temperature the greater the cooling produced by any air velocity.

"3. There is no cooling produced by moving air for a dry bulb temperature equal to body temperature at 100 per cent. relative humidity and also for a slightly lower temperature at zero relative humidity. The highest temperature at which cooling results from air motion is 123.5 deg. dry bulb and about 30 per cent. relative humidity.

"4. For any condition there is greater cooling per unit increase in air velocity for low velocities than for high. Above 300 ft. cooling is approximately a straight line function of velocity. It is therefore evident that extrapolation beyond the limits of our experimental data gives results sufficiently accurate for practical purposes."

The practical application of these charts

is obvious whether the problem is one confronting an engineer or a physician. Several examples are given showing the use of the charts for problems bearing on the improvement of ventilation conditions by circulating the air and for obtaining any desired effective temperature by such circulation. The limits of improved ventilation conditions by circulation are also shown by the charts.—P. D.

THE INFLUENCE OF ATMOSPHERIC CONDITIONS ON THE HEALTH OF THE INDUSTRIAL WORKER. *H. M. Vernon. Jour. State Med., Dec., 1923, vol. 31, pp. 561-568.*

Mortality statistics from the 1910 to 1912 data recently published by the Registrar-General (British) are discussed particularly from the standpoint of temperature and the relation of high temperature to the prevalence of phthisis, bronchitis, and pneumonia in the twelve general types of occupations listed.—P. D.

THE KATA THERMOMETER—ITS VALUE AND DEFECTS *W. J. McConnell and C. P. Yaglo-glou. U. S. Bur. Mines, Rep. Investigations, Serial No. 2565, Jan., 1924 , pp. 12.*

The history, development, and theory of the kata-thermometer and the thermodynamical principles upon which it is based are discussed and its limitations are pointed out. The accuracy of the instrument as an anemometer for measuring low air velocities is shown to be satisfactory. The curves which are plotted facilitate the reading of velocities up to 3,000 feet per minute. The kata-thermometer does not give a true index of human comfort because the surfaces of the bulb exposed are the same under all conditions of temperature and humidity. Arrangements may be made by means of adjustable metal covers to vary the wet and dry surface of the bulb according to the temperature condition of the air so as to approach the various degrees of wetness of the human body under various atmospheric conditions.

A bibliography of fifteen references is appended.—P. D.

THE CONTROL OF ATMOSPHERIC CONDITIONS IN HOT AND DEEP MINES. SUMMARY OF RESEARCH WORK CARRIED OUT FOR A COMMITTEE OF THE INSTITUTE OF MINING ENGINEERS. *Tr. Inst. Min. Eng., vol. 65, part 5, pp. 217-220.*

The conclusions of the first report to the Committee are:

1. The hindering effects on men of the heat in deep mines depend, not on the temperature of the air, but on the wet bulb temperature and the degree of stagnation of the air.

2. In the downcast shaft and main intake of a well-ventilated mine, the natural temperature of the strata has no appreciable influence either on the temperature of the air or on the wet bulb temperature.

3. The data available indicate that by properly designed ventilation and avoidance of leakage the hindering effect on men of the heat in deep mines can be obviated up to any depths at present contemplated in the working of coal or other minerals in this country.

The second report deals with the installation of a refrigerator plant in the Morrho Velho gold mine, Brazil, in which work is carried out at a depth of over 6,000 feet below the surface. Temperatures as high as 113° and 92.5° F. (wet bulb) are met with, while strenuous work is done in a good air current at a temperature of 100° (dry bulb) and 84° F. (wet bulb).

The third report deals with work by Mr. J. P. Rees on the causes of high underground temperature. This is the result of (*a*) heat due to compression of the air as it descends shafts or inclines (approximately 5½° F. per 1,000 feet vertical descent); (*b*) conduction of heat from the surrounding strata; and (*c*) heat from the oxidation of coal, other minerals, or timber. The practical importance of a large air flow in controlling underground temperatures stands out prominently as a result of these tests.

In the fourth report the work of Mr. Ivon Graham, who for several years has been investigating rock temperatures, is recorded. Considerable variations in the geothermic gradient were found. In South Staffordshire the geothermic gradient is 1° F. in 106 feet, while in South Yorkshire it is as high as 1° F. in 56 feet. The importance of bringing air to the face at as low a temperature as possible in order to minimize the effect of oxidation is emphasized. The investigations are being followed up and the excellent work done by Mr. Graham is commented on.—T. L. L.

J. I. H.
June, 1924

Cooling of Mine Air. *T. T. Read and F. C. Houghten. U. S. Bur. Mines, Rep. Investigations, Serial No. 2554, pp. 19.*

This is an exhaustive paper on the cooling of mine air and is directly applicable to the cooling of air in mines of such depth that the natural air temperature is above that at which air circulation is beneficial.

Air in deep mines is heated (above ordinary surface conditions) by two distinct methods: (1) heat produced by adiabatic compression as a result of the great pressure to which the air in mines is subjected; and (2) heat from the rocks in the mine. Of the two methods, the first is considered to be the more important, an approximate rule being a rise in temperature of 5½° F. for each 1,000 feet of descent. The temperature rise due to adiabatic compression is independent of the quantity of air circulation and is a function of depth only. On the other hand, heat given off from rocks is dependent on the area of walls exposed and the conductivity of the rocks, so that the quantity of air passing by the rocks has a great effect on the degree to which the air temperature is affected.

In terms of the "effective temperature" scale recently proposed by Houghten and Yagloglou (see This Jour., 1923-24, vol. 5, Abstr. Section, p. 173) the cooling power of mine air at various temperatures and degrees of saturation is discussed at length and is well supported by the thermophysics of heat transfer from rocks, the cooling effect of evaporating moisture from the air, and the effect of increased barometric pressure on the moisture-carrying properties of the air.

An example from published data on deep mine ventilation is analyzed in detail to show the mechanical and practical advantages of drying the entering air (by refrigeration) at the surface of the mine instead of at the deepest point in the mine or at other points part way down.

The authors conclude that the effective temperature of a ventilating current in mine workings should not exceed 80° F. if possible, and that lower effective temperatures can be secured by circulation at appropriate velocities. With effective temperatures above 85° F., no reasonable air velocity will improve conditions. Refrigeration of the incoming air, which results in a drop in wet and dry bulb temperatures, offers a practical solution of the problem; the use of liquid air, lowered pressures, and local refrigeration is not practicable from the mechanical standpoint.

A bibliography of twelve references is included.—P. D.

WOMEN AND CHILDREN IN INDUSTRY

Maternity and Work. *P. Carlini. Abstr. as follows from Rev. franç de gynéc. et d'obst., Oct. 10, 1923, vol. 18, p. 553, in Jour. Am. Med. Assn., Jan. 12, 1924, vol. 82, p. 165.*

Carlini reviews the literature and adds his own statistics to demonstrate the unfavorable influence of continuous work on parturition, and especially on the weight of the new-born. —K. R. D.

Women and Industrial Hazards. *E. Herrmann. Abstr. from Wien. med. Wchnschr., 1923, vol. 73, pp. 523-531, in Deutsch. Ztschr. f. d. ges. ger. Med., 1923, vol. 3, p. 102.*

The article deals only with such disorders as affect the sexual organs and reproductivity. The percentage of cases of lead poisoning among the women workers in type-foundries, according to the Vienna Gremial Insurance Society, is 22.28 per cent. The number of miscarriages and stillbirths and the infant mortality are twice (often many times) as high among the workers in occupations with lead hazards as among workers in other industries. Work with mercury affects reproductivity in the same way. Tobacco workers have a high sickness rate.....Anemia and menstrual irregularities are very common among them.....Contracted pelves are more common among women doing heavy work than among those doing light work, owing to their better living conditions. The number of cases of vaginal and uterine prolapse among hard working women, as well as the frequency of varicose veins and their sequelae resulting from long-continued standing, deserves consideration. The heredity of a predisposition to varicose veins should be studied by vocational advisers. Menstrual disorders,

very profuse and very frequent menses, are more common among workers who are on their feet a great deal and among the sewers using treading machines than among other women. The number of miscarriages among the obligatory members of the local Leipzig insurance societies is six times, pregnancies and births almost three times, and abnormal births almost five times as great as among the voluntary members. The Viennese insurance companies show similar conditions.—C. E.

THE TREND OF CHILD LABOR IN NEW YORK STATE, 1910-1922. *N. Y. State Dept. Labor, Indust. Commission, Special Bull. No. 122, Dec., 1923, pp. 18.*

During the period 1910 to 1922 progress has been made in strengthening the safeguards which the state has established for children. Educational standards have been raised by the requirement of further schooling before children may go to work, and by the operation of continuation schools. Legislation has limited the occupations at which children may work and has restricted the hours during which they may be employed. Closer supervision of children who have left school to enter industry has been brought about by a tightening of the provisions of the employment certificate law.

The statistics presented in this report show a reduction of the number of children at work and a gain in school attendance. The fact remains, however, that, according to the latest census enumeration, 47,024 children, 14 and 15 years of age, are employed in New York State. There is danger that since the worst evils of child exploitation have been abolished, there will be a slackening of effort and the defects and inadequacies in existing conditions will not be recognized.—M. F. M.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

INDUSTRIAL MEDICAL PRACTICE AND ITS RELATION TO GENERAL PRACTICE. *A. G. Crouch. Ohio State Med. Jour., Nov., 1923, vol. 19, pp. 788-791.*

This article is summarized as follows:

1. Industrial physicians exist in response to a need for a certain application of medical knowledge not otherwise readily obtained. The answer to this need would seem to be the development of a group of men giving their full time to this work, either with one company or several.

2. The function of industrial physicians is to do a class of medical work not otherwise adequately covered, and to supplement rather than displace medical work in other fields.

3. As in other special fields the best work depends upon co-operation, especially with the general practitioner, and this may be obtained by a better mutual understanding of functions.

4. The development of the industrial field, coupled with public health work, offers the best safeguard against encroachment upon the general medical field by schemes of state medicine or compulsory health insurance.

5. Industrial physicians are an aid to the general practitioner not only in referring to him cases directly but in serving to spread a better knowledge among the laity of the work of the profession.

6. A pressing problem requiring careful consideration by the whole medical profession is how to make fully adequate medical service available for the man of limited means, without encouraging paternalism or placing an undue burden on the patient.

WHY INDUSTRY PROFITS FROM HEALTH SUPERVISION. *H. Cheney. Industry, Dec. 15, 1923, vol. 12, pp. 1-4.*

The author of this paper believes that the profit to industry from health supervision lies in reduction of the economic loss due to avoidable sickness and disability. Among the factors which an employer should consider in estimating the amount of this loss in his own establishment are: (*a*) the cost of training new employees to replace those whom death or disability has removed; (*b*) the cost of idle machinery; and (*c*) the extent to which production has been reduced because of the lowered vitality of workers who have been ill. The total amount of these losses in their establishment is estimated by Cheney Brothers to be $267,500 per year, or approximately

$60 per employee.

A comprehensive plan for health supervision in industry concludes the article.—M. F. M.

HEALTH AS A PURCHASABLE COMMODITY. *C. F. N. Schram. Nat. Safety News, Feb., 1924, vol. 9, pp. 33-34.*

Through the operation of a system of periodic examinations, general instruction in hygiene, and advice on medical treatment, greater efficiency can be obtained in industry. The large employer should secure the services of a good industrial physician, give him co-operation, and make him responsible for lost time due to injury and disease. The smaller employer may interest a local physician, or group of physicians, in the health problem of his plant. Within natural limitations, any industry can control its sickness rate and vital capacity.—R. M. C.

REDUCTION OF MORBIDITY IN A GROUP OF TWO THOUSAND BY INTENSIVE MEDICAL SUPERVISION. *C. L. Ferguson. Ohio State Med. Jour., Jan., 1924, vol. 20, pp. 24-27.*

The author writes a very interesting article on the reduction of morbidity in a large industrial group and he gives the following factors as having contributed to a large degree toward this reduction:

1. A mutual benefit association providing free diagnostic facilities, such as X-rays, laboratory examinations, and consultations.
2. The institution of an efficient system of records.
3. A physical examination previous to employment and examination of those already employed with a subsequent follow-up of those found physically defective.
4. The institution of dental hygiene stressing the determination of focal infections and their removal.
5. The sending home of all persons with acute infectious diseases and those too sick to be at work.
6. The visiting nurse.
7. Co-operation of the worker in reporting all symptoms immediately. (The author states that during the past twelve months approximately 100 per cent. of the working force reported to the Medical Department for some kind of service.)
8. Co-operation with the family physician.
9. Frequent inspection of heating, lighting, and ventilation equipment, and general sanitary conditions with a view to correcting health hazards.
10. The vaccination of every employee against smallpox. In the face of an epidemic wholesale vaccination was advised and successfully concluded. Of the 2,000 employees, 1,800 were immediately vaccinated while the other 200 furnished certificates of recent vaccination.

The author shows some hesitancy in concluding that the low morbidity rate which he was able to obtain for the last year was due mainly to his efforts. He seems quite sanguine, however, that the same decreasing trend will be evident during the ensuing years if the same measures for the reduction of morbidity are continued.—H. B. E.

HEALTH SERVICE FOR SMALL PLANTS. *Hosp. Management, Feb., 1924, vol. 17, pp. 66-67.*

This article describes how a group of small factories or industries can secure the services of an expert industrial physician by patronizing a small hospital favorably located and adapted to serve numerous establishments. This method avoids the excessive cost of having separate medical services in small plants. —H. B. E.

TRADE UNIONS STUDY TO CONSERVE THE WORKER'S HEALTH. *G. M. Burnham. Nation's Health, Jan., 1924, vol. 6, pp. 4-5.*

The first effort to build this new scientific defense for workers started just two years ago with the organization of the Workers' Health Bureau. The Bureau has three functions:

1. Analysis and research to secure exact information regarding occupational hazards.
2. The establishment and supervision of trade union health departments to provide careful periodic physical examinations for all members, and special care for those suffering from occupational disease.
3. Health instruction for the translation of technical data into language which workers understand, in order to teach them how to safeguard themselves against occupational and other diseases.

The kind of examination offered costs but 15 per cent. of the price of the same examination "on the market." Special service is rendered without additional fees.

This bureau is rapidly becoming the health

clearing house for the trade union movement of America. It has analyzed the health hazards in forty-four trades affiliated with the American Federation of Labor and is prepared to organize a health program for any of these trades.—L. A. S.

MERCANTILE HEALTH WORK. *A. B. Emmons. Nation's Health, Jan., 1924, vol. 6, pp. 8-9, 74.*

Mercantile health work offers a new field in which to apply preventive medicine effectively. Three years ago the Harvard Mercantile Health Work was organized by a group of merchants, who furnished the funds, while the Harvard Medical School agreed to supervise the work.

The first procedure was to study the twenty-five subscribing stores from a sanitary and health point of view. A few of the sanitary defects found in these leading stores, as well as the problems involved in maintaining the good health of the workers, are described in this article.—L. A. S.

FIVE SIMPLE RULES FOR CATCHING COLD. *The Fellow Worker (Jordan Marsh Company), Dec. 1923, vol. 6, p. 17.*

This article describes a unique campaign against colds conducted by Jordan Marsh Company under the direction of Dr. A. B. Emmons of the Harvard Mercantile Health Department and Dr. H. W. Stevens. Each rule for catching cold was explained in a short dialogue and was illustrated by a pantomime.—M. F. M.

EMPLOYE SERVICE ON STATE STREET. *Hosp. Management, Feb., 1924, vol. 17, pp. 64-65.*

This article describes the health service of Carson, Pirie, Scott and Company, a large department store in Chicago. Dr. Ernest C. Cleveland is in charge, and his assistant is Dr. T. F. James. Six nurses assist them.

Dr. Cleveland relates a story of how the preliminary medical examinations which are required before an employee is engaged prevented an applicant ill with smallpox from being employed and becoming the cause of a possible smallpox epidemic. The management feels that the prevention of serious epidemics is well worth the expense of a medical service.

In the hospital there is an X-ray room and the fluoroscope is used to remove foreign bodies. The average number of cases treated per day is about 175. The firm also is sponsor for a Welfare Department, and its policy is to make the employee wish to stay and to make him understand that he has a chance to learn "something worth while that will expand one's capacity and make bigger things possible."—H. B. E.

A FURTHER STEP IN EMPLOYEE SERVICE. *Hosp. Management, Dec., 1923, vol. 16, pp. 66-67.*

For many years The International Harvester Company has provided all necessary hospital and surgical service for employees injured in the course of employment. Recently it has taken a further step in the development of its medical, as distinguished from surgical, service by providing for annual physical examinations of all employees in the Chicago plants and by establishing a diagnosis station at its McCormick works. The company does not undertake to provide medical attention for employees in whom disease is discovered at the physical examination or at the diagnosis station because the cost of such attention is not deemed a proper charge against industry. It does, however, encourage the employee in every case of this kind to procure proper medical care and advises him, through its medical staff, how to proceed.—M. F. M.

THE MILWAUKEE ELECTRIC RAILWAY AND LIGHT COMPANY. *E. W. Miller. Nation's Health, Jan., 1924, vol. 6, pp. 24-25, 70.*

When the Employees' Mutual Benefit Association of the Milwaukee Electric Railway and Light Company was organized, all employees regardless of age, sex, race, color, or infirmity were admitted to membership.

In this article is set forth a plan of procedure covering the medical and surgical care of employees of a public utility and the families of these employees.—L. A. S.

PENNSYLVANIA RAILROAD MEDICAL AND SURGICAL SERVICE. *E. B. Hunt. Nation's Health, Jan., 1924, vol. 6, pp. 10-11, 72.*

The Pennsylvania Railroad System through its relief department provides for the safety of the public and the welfare of employees by maintaining physical examinations of employees, inspection of dining cars and their

ersonnel, supervision of foodstuffs, etc., as well as making sanitary inspections throughout its territory.

Included in the many activities of the relief department are the following: first-aid and industrial medical and surgical work; physical examinations; sight, color sense, and hearing tests; regular and special periodic physical examinations of train service employees; sanitation; restaurant and dining car service examinations; dental, X-ray, and otolaryngological departments; sick, accident, and death benefits; and superannuation allowances from the relief fund.—L. A. S.

Carry Food to Workers' Benches. *Hosp. Management, Jan., 1924, vol. 17, pp. 66-68.*

With the exception of the punch-press accidents, most of the hurts at the Wahl plant are minor hand cuts caused by swiftly moving machinery. All injured employees are taken to the factory emergency hospital, where a graduate nurse determines immediately whether or not they require a physician's care. If they do, they are transferred to the offices of a nearby industrial surgeon, who specializes on cases arising in the factories of Chicago's north side, or to the Alexian Brothers Hospital.

The company has cut down hospital and medical expenses by preventive measures in the factory. During 1923 it spent approximately $7.90 per employee in medical service. This includes the sum spent on workmen's compensation insurance, the upkeep of the plant hospital, and salaries paid to employees during the first week of disability. The Illinois compensation law does not provide for the payment of compensation during the first eight days of absence from work; after that the employee receives 50 per cent. of his salary. The Wahl Company, however, pays the worker full wages all the time he is absent because of injuries or illness due to his occupation. In return, he makes over his compensation benefits to the company.

The general employee service work of the Wahl Company consists in improving working conditions, particularly for persons employed at dirty jobs. Such workers are provided with laundered aprons or jumpers and are allowed an extra fifteen minutes at noon and night. Since there are no restaurants within several blocks and there is not sufficient space in the plant for a lunch-room, the company has equipped a kitchen in which food can be prepared. The workers leave written orders for lunches and at noon their orders are delivered on specially constructed carts. —M. F. M.

How Do Employees Use the Hospital Facilities? *M. R. Lott. Indust. Management, Jan., 1924, vol. 67, pp. 58-62.*

This article describes in detail the record forms used by the health department of the Sperry Gyroscope Company. These forms were designed not only to provide adequate records of cases treated in the company's hospital, but also to furnish information as to the cause and result of accidents and the trend of disabilities and diseases, which would enable the company to eliminate conditions which lessened the efficiency of employees.

A weekly report prepared by the nurse from the daily register of cases shows the number of new cases and revisits by days of the week and gives totals for the week and the calendar year to the date covered by the report. Accidents and disabilities are so classified that an analysis according to nature and cause can readily be made from the report.

In conjunction with the weekly report, special records are kept of lost time and compensation cases and of absentees. The lost time and compensation cases are grouped to show their number and duration, and when the former develop into the latter, an adjustment is made in the records. The absentee record form is arranged to show not only the cause of absence but also the number of salaried employees involved as well as the number of workers employed on an hourly basis.

The record forms are reproduced in this article and statistics are quoted to show the distribution of cases treated in the company's hospital in 1922.—M. F. M.

Scope of Work in an Industrial Dental Clinic. *R. W. Elliott. Nation's Health, Jan., 1924, vol. 6, pp. 6-7, 62-64.*

The methods in vogue in various industrial dental clinics throughout the country vary widely. Eight types of organization to administer dental service are described. Analysis of these systems serves but to emphasize

the need of a comprehensive study of the limitations of industrial dental work.

The author has had exceptional opportunity to make such a study through his connection with industrial dentistry as practised in a successful organization comprising eighteen dental dispensaries. The scope of this work is defined under the following heads: inspection, relief of pain, prophylaxis, extractions, educational propaganda, X-ray service, fillings, keeping of records, and exceptional cases.—L. A. S.

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

Psychology and Industry in France and Great Britain. *D. Fryer. Jour. Personnel Res., Feb., 1924, vol. 2, pp. 396-402.*

"A radical difference between French and British industrialists in attitude toward development of scientific technique in personnel practice was observed by Dr. Fryer during the past summer. The French are thoroughly conservative, skeptical. The British, though wary, show a determination to get at the facts. The national scope of the British organization for promoting research in industrial psychology and physiology is noteworthy."

This article is well worth reading, for it describes the situation in France and Great Britain quite well from the point of view of an American observer. One gets a little more than the title indicates, for the differences between the attitudes of three countries, Great Britain, France, and the United States, are brought out.—H. B. E.

Measurement in Vocational Selection—An Outline of Research Procedure. *M. Freyd. Jour. Personnel Res., Oct., 1923, vol. 2, pp. 215-249; Nov., 1923, pp. 268-284; Dec.-Jan., 1923-1924, pp. 377-385.*

"This paper outlines a procedure for research in developing, evaluating, and installing measurement methods in vocational selection. It tells how to construct a vocational test and how to determine the degree of its reliability. The technique described has been carefully evolved and increasingly used by research workers but has not previously been formulated in toto. This formulation is based on the author's own experience, as well as on the accumulated knowledge of specialists who have contributed to the literature of research in vocational selection.

"This outline presupposes some familiarity with personnel administration, psychology, mental test technique and statistical methods. Although it adds little that is new to experienced investigators in this field, they will find it valuable as a check list, and as a guide to place in the hands of their less experienced assistants. It will be useful to industrial research workers and to executives who want to know at first hand what is really involved in a thorough-going program for developing improved means of selection for a given occupation. It will also find a place in connection with college courses in vocational psychology.

"The first two chapters discuss the necessary preliminary steps of vocational analysis, together with the selection or construction of the tests and other instruments of measurement. The third chapter treats of the technique of trying out the tests to determine their validity, while the final chapter deals with the installation and use of the new aids in selection."

This article will prove of value to those who are interested in research in the mental hygiene of industry. It gives in tabular form the gist of the most important methods used in present-day practice in vocational selection. Careful reading will indicate how specialists in the subject go about their work, how they evolve mental tests, and in particular what kind of statistical analysis they commonly use in the work.

There is a fairly good bibliography which, however, lays no claim to completeness.—H. B. E.

Monotony. *S. Wyatt. Jour. Nat. Inst. Indust. Psychol., Jan., 1924, vol. 2, pp. 24-30.*

The monotony of industrial work is said to be rapidly increasing, but the onset and effects of monotony are often reduced or neutralized in various ways. The operative may fall into a phantasy state of thought, while the work is performed wholly automatically.

Monotonous work has, however, a drilling effect on the mentality of the individual and gives rise to a listless attitude. This may be accentuated by the dismal nature of the surroundings, and some employers improve conditions by introducing pleasing color schemes and pictures into work-rooms. Suitable changes in the form of activity will reduce the monotony of repetitive work. In some laboratory experiments a change of work at fifty-minute intervals caused a 4 to 24 per cent. increase of output. Under industrial conditions it was found that three operatives who were engaged on a bicycle chain process improved their output 10 per cent. when they were put on to other processes during the first half of each spell.

An incentive such as a piece rate, in comparison with a time rate of payment, is very effective in the case of monotonous repetitive work, though in work which is inherently interesting its effect may be negligible. Again, the desire for promotion forms a powerful incentive in industry. The monotony of repetitive work appears to be most intense in highly intelligent persons; consequently in one factory the employment manager accepts for employment only those applicants who seem to possess just enough intelligence for the work and rejects the more gifted.—H. M. V.

The Relation between Spoiled Work and Rapid Production. *R. St. C. Brooke. Jour. Nat. Inst. Indust. Psychol., Jan., 1924, vol. 2, pp. 31-35.*

Observations were made on groups of eighteen to twenty girls who were being trained in chocolate dipping. The observations lasted four weeks, and each week (Monday to Friday) the daily output of each girl was arranged in order of productive merit, and against each day was set the amount of spoiled work made on that day. The total output figures for the most productive day in each of the four weeks were added together, and the same was done for the second most productive day, and so on. A group of learners with ten weeks' previous experience showed an average production ranging from 45 to 33, but the spoiled work, so far from decreasing as the output decreased, showed a rise from 4.5 per cent. to 5.9 per cent. Two other groups showed a similar, though less marked, increase of spoiled work with decrease of production. Probably this result is due chiefly to inattention, though it is possible, on the other hand, to be too attentive,—*e.g.*, in many forms of sport over-concentration on a particular phase of movement leads to immediate disaster. In the training system for the chocolate dipping a high standard of quality was always insisted on.—H. M. V.

The Qualities Desirable in a Foreman. *A. G. Ikin. Jour. Nat. Inst. Indust. Psychol., Jan., 1924, vol. 2, pp. 13-17.*

Data were obtained from twenty-five firms chosen to cover a fairly wide range of industry. Managers and foremen were questioned as to the qualifications which they desired, and the most important appeared to be foresight and power of organization, coupled with a capacity to lead without driving. The foreman should have ability to inspire confidence in the men, as well as to get on with the management. He should have patience, reliability, initiative, tact, imagination, character, personality. To create a supply of men qualified by capacity and education for the position of foremen would take a long time. In the meantime it is necessary to select men who actually do possess the requisite qualities and to give them the training which will help them to become efficient. In the future, emphasis on training should be at least as great as on selection. There ought to be an education *for* foremanship as it should be, in addition to a training *in* foremanship as it is.—H. M. V.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

First Report of the Departmental Committee on Compensation for Silicosis. *H. M. Stationery Office, 1924, pp. 71.*

This report is one of considerable impor-

tance. It reviews knowledge precedent to the passing of the British Workmen's Compensation (Silicosis) Act, 1918, with particular regard to the peculiar danger associated with the inhalation of silica dust, to which attention was first directed by E. L. Collis, and to the existence of this danger in the manufacture of silica (refractory) bricks.

Only one industry—the Refractories Industry—has been brought (in January, 1919) within the scope of the Act. This industry, although a small one, employing less than 4,000 persons, is important. The present report deals with the working of the compensation scheme adopted and suggests, in the light of experience gained, means for its improvement and methods of procedure for extending the provisions of the Act.

The Committee adopts the view that pulmonary silicosis is a pathological entity which is unusually liable to be complicated by tuberculosis, while, on the other hand, tuberculous infection may unmask a condition of latent silicosis, or hasten the evolution of existing silicosis. In either case an unfavorable development follows, which tends to terminate rapidly in a fatal issue.

The scheme adopted, which is operated through a compensation fund raised by a wage levy on the industry, has worked smoothly; but it has certain minor defects due to (*a*) lack of power to suspend persons suffering from tuberculosis unaccompanied by silicosis, (*b*) want of a standard to guide periodic medical examinations, (*c*) failure to eliminate men showing signs of the disease before they become disabled, and (*d*) the unfavorable financial position of the fund.

The finance of the scheme is fully reviewed, but the medical arrangements will be of more interest to our readers. The State organization for dealing with tuberculosis is used and tuberculosis officers have been employed (1) to make periodic examinations of those employed; (2) to examine newly engaged workers; (3) to examine (*a*) recently discharged workers, (*b*) workers claiming to have developed silicosis recently, and (*c*) workers claiming total disablement; and (4) to re-examine at specified intervals partially disabled persons. These medical officers have power to suspend any man from employment, the object in view being to remove affected men from the industry before they are physically impaired. They have power to refer doubtful cases to medical advisory committees. In practice, workers having silicosis in the past do not seem to have been detected and suspended from work at a sufficiently early date, possibly because of inadequate use of radiograms in diagnosis. The need for improved facilities for this purpose is stressed.

The Committee considers the responsibility for suspension too great for one man, and is not satisfied that uniformity in medical service is being attained. It now recommends the appointment of a peripatetic medical board composed of two full-time men, who shall carry out the duties detailed above. Action on these lines would accord with South African practice. The Committee also suggests that all workmen newly engaged in the industries be required to have a medical examination within one month of engagement, and that medical officers be given power to suspend from work any workmen found suffering from pulmonary tuberculosis whether accompanied by silicosis or not. But no compensation would be due for suspension on account of tuberculosis unaccompanied by silicosis. The Committee then points out that the scheme, improved as suggested, should form a suitable basis for schemes for other and larger industries in which tuberculous silicosis occurs. It lays special stress on the necessity for excluding from such industries all workmen suffering from tuberculosis of the lungs.

The report concludes with an appendix giving a useful short account of provisions for dealing with miners' phthisis in South Africa.—E. L. C.

ABSTRACT OF THE LITERATURE
OF
INDUSTRIAL HYGIENE

VOLUME VI JULY, 1924 NUMBER 3

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GENERAL

LABOUR INSPECTION. *Internat. Labour Rev., Jan., 1924, vol. 9, pp. 99-109.*

In Spain, 1920, 1921 and 1922.—The review suggests that the enforcement of factory legislation in Spain is in its infancy. Inspectors were first appointed in 1906 and their appointment tends to be leisurely. "Some employers prefer to pay the fine, arguing that as the Inspector visits them but once a year only, it is cheaper to pay the fine once a year than to abolish night work for women." Even the Sunday Rest Act is not fully complied with; while the Eight-Hour Day Decree has only become the standard for fixing wages and in establishing the limit between normal working hours and overtime. Prohibition of night work in bakeries, however, is stated to have improved the health conditions and general well-being of working bakers.

In Finland, 1921.—The organization of the inspectorate is somewhat unsatisfactory, but good work has been done. The eight-hour day was comparatively easily enforced; hygienic improvements have been effected, and welfare work is reported, particularly with regard to housing. The burden of maintaining the worker's family is directly shared by the employer in many cases. Canteens, cloakrooms, libraries, factory nurses and even factory hospitals are maintained.—E. L. C.

CHANGING FACTORY CONDITIONS. *Lancet, Feb. 9, 1924, vol. 1, pp. 304-306; Feb. 16, 1924, pp. 354-356; Feb. 23, 1924, pp. 411-413.*

These three interesting articles deal with rising standards of industrial environment and probable future development in Great Britain. They are opportune in view of the probable introduction at an early date of a bill for consolidating the Factory Acts passed since 1901. A short summary of earlier leg-

islation is given, showing that progress has taken two lines, one aimed at improving general well-being, the other at protecting against special risks.

The war period acted as a direct incentive to the first and resulted in powers being taken for making Welfare Orders; while immediately after the armistice, hours of labor were voluntarily curtailed, even in the textile industries. Human activity has since been investigated and the best length of shift can now be determined. Child labor has ceased and the half-timer, since 1920, has disappeared. New methods for controlling the occurrence of accidents have come into being; ignorance and foolhardiness among the workers are recognized to be even more important causative factors than machinery without safeguards. Illumination has been studied on scientific lines, and standards of lighting can be fixed. Protection against danger from fire calls for further precautionary measures.

The time is ripe for a new and comprehensive act designed to bring statutory powers abreast of the new conditions and to bring fresh classes of workers, such as warehousemen, clerks, housepainters, and members of the building trade, within the scope of the acts. Standards left vague in previous legislation by such words as "adequate," "reasonable," and "suitable" require to be given more precise definition. In fact, the factory code should embody the new conception of industrial life, that it may be, as it should be, healthy and educative and a good thing in itself.—E. L. C.

HOURS AND EARNINGS OF WOMEN IN FIVE INDUSTRIES. *N. Y. State Dept. Labor, Indust. Commission, Special Bull., No. 121, Nov., 1923, pp. 116.*

This study covers the confectionery, paper box, shirt and collar, tobacco, and mercantile industries.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

NEUROMUSCULAR SYSTEM

TELEGRAPHIST'S CRAMP. *Internat. Labour Office, Indust. and Labour Information, March 3, 1924, vol. 9, p. 23.*

The information on which this report is based was gathered from the postal, telegraphic, and railway authorities in Austria, Germany, France, Holland, Italy, and Switzerland. In all these countries telegraphist's cramp is not classified among industrial diseases, although in Holland it is subject to compulsory notification. The complaint has become mild and extremely uncommon since more modern telegraphic appliances have been substituted for the Morse apparatus.

THE EXPERIMENTAL PRODUCTION OF BASAL GANGLION SYMPTOMATOLOGY IN MACACUS RHESUS. *H. Mella. Arch. Neurol. and Psychiat., April, 1924, vol. 11, pp. 405-417.*

The author gave intraperitoneal injections of manganese chloride to six monkeys over periods as long as eighteen months. After varying periods of time choreic or choreoathetoid movements appeared, with muscular rigidity, disturbances of motility, and, finally, tremors and contracture of the hands. The syndrome has many points of similarity to manganese poisoning in human beings. In microscopical section, lesions were observed in the putamen and caudate nucleus and in the globus pallidus. The liver also showed degenerative changes. The similarity of the findings to those observed in Wilson's disease is pointed out.—C. K. D.

RESPIRATORY SYSTEM

STUDIES ON THE RESPIRATORY ORGANS IN HEALTH AND DISEASE. XII. THE EFFECTS OF BITUMINOUS COAL MINING ON THE VITAL CAPACITY OF THE LUNGS. *J. A. Myers. Am. Rev. Tuberc., March, 1924, vol. 9, pp. 49-56.*

The author's summary is as follows:

1. Vital lung capacity observations were made on approximately eighty bituminous coal miners whose ages ranged from 17 to 73 years. The time spent in this occupation ranged from 1 week to 57 years, with an

erage of 16.7 years.

2. The average vital lung capacity calculated from surface area, according to the methods of Dreyer and West, was 93.4 and 91.4 per cent. of the normal, respectively.

3. No appreciable decrease in capacity was observed below the age of 46 years, or 24 years of service in the mines. The lower averages after these periods were attributed more to advancing age than to occupation.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

A New Improved Hand Apparatus for the Rapid Determination of Carbon Monoxide. *R. Winkler. Abstr. as follows from Montan. Rundschau, 1923, vol. 15, pp. 569-571, in Chem. Abstr., Feb. 20, 1924, vol. 18, p. 486.*

The "Palkon" apparatus consists of a glass vessel in which is suspended a strip of white filter paper moistened with an aqueous solution of a palladium salt. The air to be tested is forced by a rubber bulb pump through a tube containing meerschaum moistened with silver nitrate, to remove coal dust and other organic substances, into the vessel, and the time required for the paper to begin to darken is noted. The corresponding percentage of carbon monoxide is read from a diagram. It is accurate to 0.01 per cent.—P. D.

Hydrogen Sulphide Literature. *C. W. Mitchell and S. J. Davenport. U. S. Pub. Health Rep., Jan. 4, 1924, vol. 39, pp. 1-13.*

A bibliographic review is given of the most important articles on the subject of hydrogen sulphide poisoning. Hydrogen sulphide is one of the most toxic of the gases. It is comparable to hydrogen cyanide in the rapidity of its action and the concentration from which death will result. In concentration of 0.005 it will cause poisoning, and this low percentage is often found in certain industries. The exact mechanism of its poisonous action is still unknown.—B. C.

Mercurial Poisoning. A Report on Poisoning from Small Quantities of Mercurial Vapor. *J. A. Turner. U. S. Pub. Health Rep., Feb. 22, 1924, vol. 39, pp. 329-341.*

An account of poisoning from inhaling mercury vapor liberated into the air by volatilization of alcohol-cooled mercury contacts in 10 and 20 kilowatt induction furnaces used in an experimental laboratory.

Examination of dust from shelves around the laboratory showed the presence of mercury. Determinations in the air while the furnace was running were made (1) by the Palmer apparatus containing aqua regia and (2) by an amalgamator method in which the air was passed between gold leaves and the increase in weight of the gold noted.

No distinction is made between mercury vapor (gas) and mercury fume (fine particles of mercury). Quantities of 0.02 mg. of mercury per cubic foot breathed over periods of two or three months for three to five hours daily are estimated to give daily absorptions of 0.771 to 1.285 mg.—amounts which the author believes sufficient to cause mercurial poisoning.

Symptomatology and physical examinations of a number of persons exposed are given in detail. The remedies suggested are better ventilation and adequate hoods.—P. D.

Rubber Solvents from the Standpoint of Industrial Hygiene. *E. Kohn-Abrest. Chimie et Industrie, Feb., 1924, vol. 11, pp. 382-386.*

The solvents which the author discusses, mentioned in the order of the assigned relative toxicity of their vapors, are carbon tetrachloride, ethylene tetrachloride, ethylene trichloride, ethylene dichloride, chloroform, pentachlorethane, and tetrachlorethane.

The author states that all of these have definite and somewhat similar physiological action in small amounts although large doses of the different vapors may cause unlike effects. In general, factories using these substances should enforce sufficient ventilation to render the vapors undetectable by sense of smell. Quantities as small as 1 mg. of benzol per liter of air can be detected by smell, while a dangerous quantity is about 10 mg. per liter. Two or 3 mg. of tetra-

chlorethane per liter are considered dangerous and the permissible quantity should be below 1 mg.

Quantitative determinations of these chlorinated compounds in air are made by washing the air in an alcoholic potash solution and determining the liberated chlorine.—P. D.

SYMPTOMATOLOGY OF CHRONIC LEAD POISONING—A CASE OF CEREBELLAR ATAXIA AS A RESULT OF CHRONIC LEAD POISONING. *H. Kraffczyk. Deutsch. Ztschr. f. Nervenh., Nov., 1923, vol. 80, pp. 184-203.*

The author presents in detail the history of a case of chronic lead poisoning which he has followed for several years. During this time there have been several periods of marked improvement with several relapses, during which symptoms of lead poisoning have been marked. Stippling of red cells, anemia, nystagmus, and general weakness were noted but invariably the chief symptom was ataxia, which the author believed was entirely of cerebellar origin. A review of the literature on the relation of fatigue to paralysis is given, and the author points out that in his case the parts of the body most affected were those which were most fatigued. He emphasizes the fact that the nerves are affected before the muscles and therefore we should speak of the nerves rather than the muscles which are most used as being predisposed to paralysis.

The respiratory tract is the chief portal of entry for lead; of next importance is the gastro-intestinal tract, while the skin is of very slight importance.

A discussion of chemical data in regard to the lead content of the central nervous system in cases of lead encephalopathy is given.

The analysis of the spinal fluid for lead in this case gave a negative result. From this finding and the literature the author decides that lead may do much damage to the central nervous system without being stored there to any great extent. He believes that during the years of exposure, before symptoms were noted, lead was accumulating in some tissue, possibly the bone marrow, and that this lead was in some way brought into solution at intervals, causing symptoms of poisoning.—A. S. M.

LEAD POISONING AND ZINC FEVER AMONG WRECKERS. *L. Schwarz. Abstr. as follows from Ztschr. f. Hyg., 1923, vol. 100, nos. 3 and 4, in München. med. Wchnschr., Jan. 4, 1924, vol. 71, p. 21.*

Extensive studies of a number of cases of lead poisoning in the wrecking industry were made. Special precautions against lead in this industry are still lacking. The author discusses the needs and makes certain suggestions. He points out that respirators alone cannot shut out all the danger. He recommends alternating work at dangerous indoor trades with work in safer surroundings.—A. S. M.

DUST HAZARDS AND THEIR EFFECTS

EXPLOSION OF CORK DUST CAUSED DEATH AND INJURY TO EMPLOYEES IN THE BOILER ROOM OF A FACTORY WHERE DUST COLLECTORS WERE LOCATED. *Indust. Bull., Jan., 1924, vol. 3, p. 82.*

Dust created by a double cylinder sander, used for surfacing cork floor blocks, was conveyed to a cyclone separator by means of an 8-inch pipe about 150 feet in length. The dust outlet pipe from the lower section of the collector was arranged in such a manner that the dust could be blown by the action of the fan in connection with the exhaust system into the fire-box of a vertical tubular boiler and there burned. The air outlet pipe from the top of the separator led to the furnace of an unused horizontal water tube boiler, where all cork dust not caught in the separator was deposited.

At the end of the day, the collected dust in the cyclone separator was blown into the fire-box of the vertical boiler and consumed. On the day of the explosion, when the hood or connecting portion between the dust separator and the discharge pipe was removed, smoke was seen issuing from crevices in the pipe leading from the cyclone separator to the furnace of the horizontal water tube

boiler. When two employees attempted to put out the fire by directing a stream of water upon the air outlet pipe, an explosion of the dust in the furnace of the horizontal water tube boiler occurred, evidently caused by the ignition of the smoldering dust in the cyclone separator, which no doubt was kindled by a back draft from the vertical boiler when the cyclone separator was emptied of its dust.—R. M. C.

INDUSTRIAL DUST PARTICLES AND THEIR PREVENTION. *E. Brezina. Zentralbl. f. d. ges. Hyg., Feb. 25, 1924, vol. 6, pp. 337-345; March 10, 1924, pp. 417-426.*

An excellent survey of the literature since 1912 on dust particles, including their entrance into and absorption by the organism, the industrial hazards due to dust, and the precautions and apparatus necessary to lessen such dangers. The author adds a valuable bibliography.—C. E.

VENTILATION AND DUST CONTROL IN METAL MINES. I, II. *P. H. Warren. Abstr. as follows from Chem. Eng. Mining Rev., 1923, vol. 15, pp. 431-436; vol. 16, pp. 13-18, in Chem. Abstr., Feb. 20, 1924, vol. 18, p. 515.*

The control of dust intensity in metal mines depends on (1) the selection of machines for boring in which water is effectively applied mechanically, (2) the continued wetting down of working places and piles of broken material, (3) the limitation of firing as far as practicable till the end of the shift and the use of water blasts to cope with the dust produced by firing, (4) the proper co-ordination of all of these factors with adequate ventilation.—P. D.

TRANSPORTATION AND DISPOSAL OF DUST IN STONE HEWERS. *A. Christ. Abstr. as follows from Frankfurter Ztschr. f. Path., vol. 29, no. 3, in München. med. Wchnschr., Jan. 18, 1924, vol. 71, p. 86.*

In silicosis, disposal of dust by way of the lymphatics leads to a high concentration of dust in the lymph nodes. Silicic acid determinations show as high concentrations in the lymph nodes as in the lungs themselves. An increased silicic acid concentration was also found in the spleen, which indicates that dust is disposed of by way of the blood stream as well.—A. S. M.

THE PRESENCE OF SILICON IN TISSUES. *L. Isaacs. Bull. Soc. de chim. biol., Feb., 1924, vol. 6, pp. 157-168.*

The author has determined the silicon content (as silica) of the more important organs from seven human subjects, one dog, and four rabbits. Included in the first group are various male and female subjects of ages varying from 1 week to 62 years. It is concluded that for a given individual the silicon content of the normal organs is constant and more or less uniform, the average found being 1.5 mg. of silica per 100 gm. of fresh tissue. In two of the cases quoted (a child killed by accident and a man who died of diabetes and pneumonia) the lungs contained more silica than the other organs. The same observation was made in the case of the dog. The rabbits, which show relatively high silicon contents in all organs, were remarkable in that the brain contained much more silicon than the other tissues. It is suggested that in this case the silicon may be present in the form of a silico-lipoid as an essential brain constituent. The high silicon content of the rabbit is ascribed to its nutrition and not to dust inhalation, since the lungs contained no more silicon than the spleen. The silica determinations were made by a micromethod which is fully described in the original.—J. P.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

THE EFFECT OF CARBON ON THE TUBERCLE BACILLUS IN VITRO AND ON EXPERIMENTAL TUBERCULOSIS IN THE RABBIT. *H. J. Corper, A. C. Starry, and M. B. Lurie. Am. Rev. Tuberc., Feb., 1924, vol. 8, pp. 530-553.*

Carbon inhaled as soot, prepared by burning xylene, is deposited mainly in the lungs of rabbits after prolonged inhalation. The deposition in tuberculous lungs is, however, irregular, not conforming to any definite pattern or rule. There are many areas in the lungs comparatively free, microscopically,

from carbon, and likewise, many tubercles only partially surrounded with carbon or free from it. Even though inhalation was initiated twenty days before infection by intravenous injection, the centers of the tubercles were free from carbon.

Carbon administered in liquid suspension (India ink) daily and intravenously to rabbits for long periods (about forty-seven days) is found deposited mainly in the liver, spleen, bone marrow, lungs, lymph nodes, and, to a slight extent, in the kidneys and heart; the brain, thyroid, adrenals and gastro-intestinal tract are relatively free from it. The liver and spleen retain far more carbon than the lungs. The intravenously injected carbon was more diffusely and uniformly deposited in the lungs than the inhaled carbon, although the centers of tubercles were likewise free from carbon, even though carbon injections were initiated ten days before infection.—P. D.

Anthrax in the British Empire. *Internat. Labour Rev., Feb., 1924, vol. 9, pp. 242-256.*

This article sets forth the prevalence of anthrax in various parts of the British Empire. In Great Britain in the period 1911 to 1920 less than 650 cases occurred annually among animals, of which over 90 per cent. were among cattle. About 69 per cent. of the cases were due to the importation of infected feeding stuffs and artificial manure. In human beings in the period 1907 to 1920 about thirteen cases occurred each year which were of agricultural origin and sixty-two which were of industrial origin. Of the industrial cases reported in the period 1899-1922 52.4 per cent. occurred in the woolen industry, 28.1 per cent. from hides and skins, and 13.7 from hair and bristles. The case mortality was 18.7 per cent. Detailed information is given concerning the occurrence of cases during the past fifteen years in each of these industries. Most of the infected wool came from Egypt, Persia, the East Indies, China, and Tibet. Fifty cases with eighteen deaths were caused by using infected shaving brushes in the years 1915 to 1921.

In Canada but little is known of the occurrence of anthrax among animals and but few cases of the disease occur among human beings. In the Union of South Africa the disease is endemic among animals and tends also to occur in definite outbreaks; seventy-five deaths among human beings in 1921 were ascribed to it. In New Zealand the disease practically does not exist.—E. L. C.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

A Case of Le Pigeonneau. *A. Léri and R. Barthélemy. Bull. Soc. franç. de dermat. et syph., Feb., 1924, p. 71.*

This skin trouble is seen occasionally in fellmongers who prepare the pelts for the tanners. The patient had only worked a fortnight at this trade when the symptoms developed. His duty consisted in carrying the wet hides to and from the "soak pets" in his bare hands and arms, unprotected by gloves and other suitable clothing. On some of the knuckles of both hands appeared the typical ulcers. On other parts exposed to the irritating liquors the "breakings out" were not so characteristic. Unfortunately the reporters were unable to discover the exact chemical agent or agents responsible.

Each sore begins as a crack which slowly deepens and becomes round or oval and covered over with a dark or black crust. The edges are clean cut, as with a punch. There is no zone of redness round each lesion, but in its place a good rim of raised opaque epidermis which stands out as a sharp contrast to the dark center. Hence the resemblance to a "bird's eye" from which the name is derived. About a dozen of these excoriations were present. The men complain that they cause sharp pain during the day and itch at night. These ulcers are slow to heal.

The plate which accompanies the report gives an excellent picture of the condition. —R. P. W.

The Causes of Fur Dermatosis. *R. P. White. Jour. State Med., Jan., 1924, vol. 32, pp. 16-24.*

White has drawn attention to a new occupational dermatosis arising from contact with

cheap dyed furs. The furs are usually cured with arsenic and mordanted with various substances, depending upon the color and nature of the material used for dyeing. The dyes in general use are the hydrochlorides of para-phenylenediamine, para-amido-phenol and diamido-diphenylamine. Pyrogallic acid is occasionally used and also quinone to alter the color produced by para-phenylenediamine chloride. Dyeing is carried out either by dipping or by the brush or topping method.

In investigating the rash of girls engaged in cutting furs, the author found that pieces of the fur bound on his arms produced a rash which was due only to the dye and not to arsenic or a mordant. Similar experiments with para-phenylenediamine also produced a painful rash. Quinone, when dry, produced no effect, but when moistened it brought out a brilliant erythematous rash. The author emphasizes the danger of the dust of these poisonous substances.—L. T. F.

THE RELATION OF EYE-STRAIN TO INDUSTRIAL EFFICIENCY. *F. H. Cook. Ohio State Med. Jour., Feb., 1924, vol. 20, pp. 89-92.*

The author believes that every employer serves his own best interests by taking pains to have defects of vision among his employees corrected. An applicant for employment should have a thorough examination of the eyes, which will reveal any new or old pathological conditions. Central vision should be determined and the fields taken, as a workman with normal central vision but with a restricted field is of little value. In employees whose work requires close application over a prolonged period the accommodation should be measured and the relative strength of the extrinsic muscles taken. The ocular findings should be made a matter of record and should be of value in assigning an employee to the kind of work for which he may be best suited. Under the present system an employee may suffer an injury and claim indemnity for an eye in which he may have had no useful vision at the time when his employment began.

The experience of the Whiting-Davis Company of Plainville, Mass., is cited. Because the work produced in their plant was below par in several respects, the eyes of all their employees were examined. It was found that 8.4 per cent. possessed normal vision; 8.3 per cent. were already wearing properly fitted glasses, while 83.3 per cent. were in need of corrective lenses. When the 83.3 per cent. had been equipped with glasses, production at once increased 28.03 per cent., and the workers kept more steadily at their tasks, so that the entire morale of the working force was strengthened.—M. F. M.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

ACCIDENT STATISTICS AND ACCIDENT PREVENTION. *R. Meeker. Safety Engin., Feb., 1924, vol. 47, pp. 55-58.*

In the state of Pennsylvania, Dr. Meeker states, there has been an increase in the number of industrial accidents for the year 1923 over the years 1920, 1921, and 1922. To remedy this, he suggests: (*a*) the formation of safety committees to study the causes of industrial accidents and illness; and (*b*) the keeping of time records, so that one can actually know the number of accidents per man-hour. He summarizes the study of accidents which occurred in 1923 in the state of Pennsylvania as follows:

Over 5,000 persons were injured by stepping on upturned nails or other sharp objects.

Under the heading, Fall of Persons, more people are injured in tripping, stumbling or falling on the level than are injured by falling from scaffolds, ladders, or other elevations, or into excavations.

Under the heading, Handling of Tools or Objects, the majority of injuries occur to those who are carrying or lifting material. This does not include those unloading or loading material.

Increase of industrial accidents can be attributed to: greater number of persons employed, including increased production, increase in labor turnover, lack of safety education or adoption of safety methods, and let-up of interest in safety.

Accidents can be reduced provided management authorizes and carries out safety campaigns and employees are instructed and become interested in promoting safety.

At least 90 per cent. of accidents in the state are caused as a result of carelessness of someone—not always the persons injured.

If every person in industry was careful, 2,000 lives would be saved and 150,000 would be saved from injury every year.

Employers and employees must work in close co-operation to prevent accidents.—H. B. E.

CAUSES OF ACCIDENTS IN HANDLING MATERIAL. *D. S. Beyer. Safety Engin., Feb., 1924, vol. 47, pp. 101-106.*

This very interesting article is quite instructive. The author gives statistics for two years for Massachusetts, showing that approximately one-fourth of all industrial accidents in a typical manufacturing state are due to handling of material. He discusses the human side of the material-handling problem and gives a summary of sixteen cases which illustrate the necessity of prevention.

Beyer emphasizes the following points:

1. The important place which the foreman holds in such work. When heavy objects are being handled the lives of his men may be imperiled any moment by lack of judgment or proper caution on his part.

2. The necessity for selecting the man for the job, so that individuals with heart trouble or other organic weaknesses or diseases will not be placed in work where this weakness may endanger their lives.

3. The importance of prompt antiseptic treatment of the small cuts and scratches which inevitably occur where rough objects are being handled.

4. The use of mechanical appliances, wherever they can be adopted for handling heavy weights, and the frequent inspection of such appliances in use to see that they are not allowed to get out of order or to be used improperly.—H. B. E.

ELIMINATION OF ACCIDENTS BY THE USE OF CONVEYORS. *F. D. Campbell. Safety Engin., Feb., 1924, vol. 47, pp. 98-100, 106.*

The author lists the chief causes of accidents in the handling of material in the order of their importance as follows: (*a*) physical fatigue, (*b*) mental fatigue, (*c*) lack of safety measures, (*d*) poor working conditions, (*e*) poor lighting conditions, (*f*) inexpertness, (*g*) ignorance, and (*h*) carelessness.

He believes that the installation of conveyors of different sorts will help considerably in the cutting down of accidents due to handling of material. He describes a number of mechanical appliances for this purpose. It will be worth while for any reader who is interested in the details of the subject from the mechanical side to read this article in the original.—H. B. E.

ELECTRICAL SAFETY INSPECTION: SUGGESTIONS FOR MINE-SAFETY ENGINEERS. *L. C. Ilsley. U. S. Bur. Mines, Rep. Investigations, Serial No. 2541, Nov., 1923, pp. 10.*

"This paper is intended for State mining inspectors, safety engineers of mining companies, and others interested in electrical safety inspection in mines. It presents the important points that should be watched by inspectors, and briefly reviews the work of the Bureau of Mines in the testing of electrical apparatus or equipment to determine their permissibility for use in gaseous coal mines."

Under the caption "Important Points in Inspecting Mine Electrical Installations or Equipment," there is a questionnaire with forty questions and instructions as to what to look for and what should be expected. This is very valuable for safety inspectors.

Under "Electrical Safety Work of the Bureau of Mines," there is a short sketch of the activities of the Bureau.—H. B. E.

INDUSTRIAL SURGERY

INJURIES TO THE HEAD AND THEIR SEQUELAE. *R. Lewy. N. Y. State Dept. Labor, Med. Div., Bull. No. 3, Dec., 1923, pp. 44.*

Dr. Lewy summarizes his paper in the following words:

Injuries to the skull need not show immediate external manifestations at the site of the injury.

There are fractures of the skull, fissure fractures as well as fractures at the base, which at certain times do not show immediate manifestations of injury nor immediate

equences.

The sequelae following injuries of the skull may be very severe after mild injuries, and may be very mild after fractures of the skull.

Loss of consciousness following an injury to the skull, either of short or long duration, need not be a sequence of a fracture to the skull, but is always an indication of a concussion of the brain.

Concussions of the brain need not be accompanied by a fracture of the skull.

As fractures of the skull are often overlooked, in consequence either of no external manifestations of the injury, or of no immediate post-traumatic sequelae, it is advisable to radiograph every skull after an injury due to a fall, or some heavy object striking it.

Where there has been unconsciousness following an injury to the skull, and although there has followed a remission of apparent well-being, the prognosis as to future developing neurosis and its sequences should always be considered.

Slight injuries to the skull which may have no serious post-traumatic effect upon an apparently normal individual may cause a severe disbalance in the personality of an individual who has neurotic tendencies. An injury to the skull in a person having suffered from infections, as syphilis, or who has been addicted to excessive use of alcohol, may be the precipitating factor for the development of a psychosis.

A differential diagnosis between functional neurosis and simulation or malingering is at certain times very difficult, and sometimes impossible. Each case must be studied individually by a skilful and mature clinician. —H. B. E.

THE INFLUENCE OF INJURY ON BONE AND JOINT DISEASES. *R. Whitman. N. Y. State Dept. Labor, Med. Div., Bull. No. 2, Sept., 1923, pp. 4.*

Dr. Whitman summarizes his paper as follows:

I conclude then that injury may disseminate and localize disease, the germs of which were quiescent in the body.

That it often brings to light latent degenerative changes classified as arthritis deformans.

That it induces these changes directly and indirectly in certain instances and if these changes are present it may aggravate both symptoms and effects.—H. B. E.

FOCAL INFECTION AS A CAUSE OF PROLONGED DISABILITY IN INJURIES. *W. W. Harper. South. Med. Jour., Jan., 1924, vol. 17, pp. 29-30.*

The author states that in all cases of bone and joint injuries the surgeon should be alive to possible damage from focal infections, which often prolong disability, thereby giving rise to unjust suspicions of malingering. Cases are cited.—M. F. M.

HEAT, COLD AND HUMIDITY

THE EFFECTS OF EXPOSURE TO HIGH TEMPERATURES UPON THE CIRCULATION IN MAN. *E. F. Adolph and W. B. Fulton. Am. Jour. Physiol., Feb., 1924, vol. 67, pp. 573-588.*

Previous experiments in the special psychrometric rooms at the Bureau of Mines Experiment Station, Pittsburgh, showed that the most notable index of distress in subjects exposed to high "effective temperatures" was pulse rate and that body temperature was less important.

The present paper deals particularly with circulatory changes, and especially with the balances of acids and alkalis in the blood as being the "most important factor in the control of the respiration and circulation."

Tests were made when the subjects were standing, sitting, lying down, and engaged in moderate exercise: in some cases, the effects of bandaging the legs were investigated.

The authors' conclusions are:

1. Exposure to high temperatures increases the loss of carbon dioxide from the blood through the skin and lungs. This lowering of the carbon dioxide tension increases the hydrogen ion concentration of the blood and ultimately leads to an excretion of alkali from the blood. The carbon dioxide dissociation curve of the blood is not significantly altered.

2. The peripheral blood vessels are great-

ly dilated during exposure to high temperatures, and this dilatation continues indefinitely. The lack of a high resistance in the peripheral vessels prevents blood from returning to the heart.

3. The heart rate increases steadily and rapidly, and is even able to increase the systolic blood pressure. In spite of this compensating activity on the part of the heart, the blood flow back to the heart finally becomes inadequate. At this point, circulatory failure or shock is complete, with faintness.

4. The rise in skin temperature seems to play the initiatory part in the control of the respiratory and circulatory reactions.—P. D.

EFFECTIVE TEMPERATURES FOR STILL AIR CONDITIONS AND THEIR APPLICATION TO MINING. *F. C. Houghten, C. P. Yagloglou, and R. R. Sayers. U. S. Bur. Mines, Rep. Investigations, Serial No. 2563, Jan., 1924, pp. 10 and charts.*

This report deals with the same general subjects described by these authors in previous papers. (See THIS JOUR., 1923-1924, vol. 5, Abstr. Section.) A simplified chart for reading effective temperatures has been added. Wet and dry bulb temperatures are plotted as ordinates and abscissae, respectively, and with the exception of 0 per cent. and 10 per cent., the relative humidity lines are approximately straight.

The application and physiological significance of the effective temperature scale is discussed in the same general manner as in their other papers.—P. D.

SOME EFFECTS OF HIGH AIR TEMPERATURES UPON THE MINER. SIXTH REPORT TO THE COMMITTEE ON THE CONTROL OF ATMOSPHERIC CONDITIONS IN HOT AND DEEP MINES. *K. N. Moss. Tr. Inst. Min. Eng., Feb., 1924.*

The ability to win coal at great depth depends on overcoming the effects of underground air temperature. An analysis of the caloric value of the diets used by eighty miners in seven colliery districts was made. The average caloric value per man per day was found to be 4,711 calories. The average total liquid drunk was 6.55 pints. The diet showed an increase of salt in the deep mines. The energy output of a miner at work was compared with the caloric value of the food eaten. The food consumption of a "particularly energetic" collier was found to be 6,02[illegible] calories and the work output to be 4,767 calories.

The regulation of the body temperature during work in hot mines is a function of the nervous system and is controlled by chemical and physical means. In the miner the physical means are the more important. In temperatures above 98° F., loss of heat can be obtained only by evaporation of water from the skin and lungs. Unacclimatized persons cannot lose more than 1½ pounds of sweat per hour, while colliers who are used to working in hot places may lose 3.7 pounds. From experiments the following conclusions are drawn:

1. For fixed conditions of temperature and humidity an increase in the work output is accompanied by an increase in the sweat loss and apparently also in its sodium chloride concentration. Where there is much sweating, the loss of chloride from the body is very large.

2. There is a marked difference in the amount of sweating between the man acclimatized to hard manual work under high temperature conditions and other men. The collier loses more than twice as much sweat.

In two deep pits where the temperature varies between 98° and 102° F. dry bulb and 83° and 87° wet bulb, cases of cramp in miners are reported. In the last hours of their shifts the miners are attacked with severe muscular pains in their arms, legs, or abdomen. The sufferers attribute their condition to (*a*) high air temperature, (*b*) excessive water drinking due to the high air temperature, and (*c*) continued hard work. It was suggested by Dr. Haldane, who was called in to advise by the colliery management, that the condition was due to an excessive loss of chlorides from continued sweating. It was found that the urine passed by the sufferers was very scanty and contained no chlorides. The loss of chlorides in the sweat leads to shortage in the blood and to a condition comparable with the "water poisoning" of animals described by Rowntree. The ingestion of water into the stomachs of animals through a tube produces muscular twitchings and convulsions. Experiments were carried out in which men were supplied with drinks containing sufficient chlorides to compensate for the loss of salt by sweating. The results were very satisfactory; the men found that they required less fluid, worked in more comfort,

and felt less fatigue at the end of the shift. The attacks of cramp did not recur. It was found in later experiments that a mixture of potassium and sodium chlorides gave the best results.

The paper was followed by an interesting discussion in which several speakers, including Sir J. Cadman, Dr. R. R. Sayers (U. S. A.), and Dr. Haldane took part.

Dr. Haldane said that animals reduced their temperature by sweating and quoted the startling experiment carried out by Blagden in the eighteenth century. Blagden took with him into a room at the temperature of 230° F. in dry air an uncooked steak which he watched frizzle before his eyes. People drink because their throats are dry from (*a*) loss of moisture from the throat when they are panting through the heat, and (*b*) the drying up of the salivary glands. In moist air, such as occurs in the Cornish mines where the temperature might be 93° F. wet bulb, the miners do not drink much and do not suffer from cramp. When one sweats one increases the concentration of salt in the blood, and water is added to counteract this excess. If too much water is added, cramp follows. Three conditions are necessary to produce cramp: (*a*) the man must be working, (*b*) the air must be dry, and (*c*) the man must be drinking too much water.—T. L. L.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

Depreciation of Lighting Equipment Due to Dust and Dirt. *E. A. Anderson and J. M. Ketch. Tr. Illuminating Engin. Soc., Jan., 1924, vol. 19, pp. 55-65.*

Tests were made (1) under service conditions to determine the relative depreciation or loss in efficiency of lighting equipments due to the accumulation of dust and dirt; and (2) under forced rates of dirt accumulation, in an effort to determine the feasibility of obtaining quick comparisons between the depreciation rates of different equipments. Consideration of the possibilities of a simple comparison standard for predicting depreciation rates in a particular installation is included.—P. D.

Some Experiments on the Speed of Vision. *P. W. Cobb. Tr. Illuminating Engin. Soc., Feb., 1924, vol. 19, pp. 150-163.*

The question of the time required to make an adequate visual impression has recently become of fundamental interest to industrial lighting.

This "time of impression" will depend upon many conditions of vision, such as (*a*) the size and distance of the object; (*b*) its brightness compared with that of its background; (*c*) the general level of brightness; (*d*) whether vision of form is necessary, or the simple "picking-up" of the object; and (*e*) the reduction in effectiveness of the image of the object due to images of other objects seen immediately before and after it.

The working out of a complete law of the "speed of vision" will be a tremendous task, when the representative variations of each of these factors have been considered. The present paper is a contribution to this work and shows in what way the speed of impression of the eye changes with change in the brightness-level, under various conditions as to the size of the test-object, as to the necessity for seeing form as against the simple recognition of the presence of the object, and as to the presence or absence of confusion due to the images of other objects seen immediately before and after the test-object.—P. D.

The Effects of Quantity and Quality of Illumination upon the Human Eye and Vision. *C. Sheard. Safety Engin., Feb., 1924, vol. 47, pp. 91-98.*

Dr. Sheard goes into some detail in taking up the question of illumination and vision. He summarizes his article as follows:

1. The first fundamental principle of good lighting is that the light must shine on the object under gaze but not in the eyes of the observer.

2. The first remedy is the use of diffusing glass globes, reflectors or shades.

3. The contrast of brightness should be kept within a ratio of 1 to 100. This means the adoption of indirect lighting or semi-

indirect light in which the brightness of the bowls is reduced.

4. Localized lighting should be used only in conjunction with some good general system of lighting, so as to avoid too marked contrasts.

5. An important point in illumination where close visual work is to be performed is so to arrange matters that the glare of reflection from polished surfaces is avoided.

6. The eye works with approximately normal efficiency upon surfaces possessing an effective luminosity of about one lumen per square foot.

7. Excessive illumination as well as inadequate illumination strain and fatigue the eye in order to secure sharp definition.

8. Intrinsic brilliancy of more than 5 candle-power per square inch should be reduced by a diffusing medium if the rays enter the eye at an angle below 60 degrees with the horizontal plane.

9. Flickering, unsteady or streaky illumination strains the eye and produces retinal irritation in the eye in its endeavors to maintain vision.

10. Ultraviolet radiation percentagely in excess of that present in daylight as well as infra-red radiation from high temperature molten surfaces are to be avoided for hygienic reasons through the use of special protective glasses.

11. The psychological laws of association and suggestion should be regarded since, if there is total absence of visible light sources and of shadows, there may be complaints.

12. In natural lighting through windows, the windows should be as large a percentage of the total wall area as possible, ordinarily.

13. Window shadows indiscriminately used are conducive to contract glare effects. Translucent screens or shades are generally far better.

14. Ground glass and such like should be avoided in window sashes which are below the level of the eye as they cause an increase of brightness in the retinal images thrown on a portion of the retina unaccustomed to such brightness.

15. Dark colored finishes, walls and ceilings of rooms should be avoided if ocular comfort is desired, since glaring contrasts are likely to be introduced.

16. Illumination conditions are important factors in conserving vision and enabling it to be comfortably carried on. If illumination conditions are good and eyes fatigue and ache, then the remedy may be in the hands of those who make it their work to alleviate refractive errors of the eye. The ideal state of affairs is that in which a pair of eyes, functioning normally either naturally or through the assistance of proper correcting lenses, works under proper illumination.—H. B. E.

SULPHUR TRIOXIDE SMOKE TUBES FOR DETERMINING AIR CURRENTS. *S. H. Katz and J. J. Bloomfield. Abstr. as follows from U. S. Bur. Mines, Rep. Investigations, Serial No. 2505, 1923, pp. 2, in Chem. Abstr., Oct. 20, 1923, vol. 17, p. 3263.*

The apparatus used to determine the flow of air, direction of the currents, and the rate of mixing consists of a glass tube containing fuming sulphuric acid on granular pumice stone attached to a rubber syringe bulb. A squeeze of the bulb blows air through the tube, causing the evolution of a stream of dense white smoke. After preparation the tubes are sealed, and when ready for use are broken at a file scratch on both ends and inserted into a rubber nipple at the bulb. —P. D.

DISTRIBUTION OF AIR IN METAL-MINE VENTILATION WITH ESPECIAL REFERENCE TO FLEXIBLE TUBING METHODS. *D. Harrington. U. S. Bur. Mines, Rep. Investigations, Serial No. 2551, Dec., 1923, pp. 11.*

This is an eleven-page report with an excellent summary, of which the following forms a part:

"Blind ends" include most of the working faces in metal mines and, in general, they are unventilated except that a limited amount of compressed air (approximately 100 cubic feet per minute) is liberated during part of the working shift.

Use of flexible tubes with small blowers furnishes probably the most efficient and most economical method to date for ventilating "blind ends."

By flexible tubing methods quantities from 1,000 to 5,000 cubic feet of air per minute are readily released at face of "blind ends" up to or even over 2,000 feet from circulating air.

J. I. H.
July, 1924

When the air of working places is hot, stagnant, and impure, there is danger of excessive accident occurrence which is removed upon giving of adequate ventilation by flexible tubing system.

Many investigators who have spent much time as to cause and prevention of miners' consumption now believe that by far the best preventive is the circulation of ample quantities of pure fresh air at working places; to accomplish this there is certainly no better agency than the use of flexible tubing and blowers.

Mining companies, both where air is hot and humid and where the air is cool but impure, have found efficiency of workers so greatly increased by the installation of fan and tubing systems that there has not been one case of abandonment of the system, though there are several hundred instances at hand of its adoption.—P. D.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

How Western Electric Company Cares for 38,000 Employees. *S. P. Moore. Nation's Health, Feb., 1924, vol. 6, pp. 89-91.*

The difficulty of finding any proper estimate of general medical service enhances the value of industry as the one laboratory from which adequate records may be obtained. This is particularly the case where the industrial population is the chief civic population, for here the industry dominates the whole community and the community service is an extension of the industrial service.

The plant hospital of the Western Electric Company is one of the largest and most adequate industrial hospitals in the country. The personal equation of the worker is everywhere given full consideration. Physical examination is outlined in strict accordance with functions to be performed. The unhappy, fatigued, or inadequate employee is detected and diagnosed without his realizing it.

The welfare of employees, however, is secured in many and diverse forms of service. Safety is assured through suitable engineering activities; seats are adapted to the requirements of the worker; lunches are served in a favorable environment; a company store sells at wholesale prices; study classes receive both technical and non-technical education. All of these activities have proved conducive of both production and stability. —L. A. S.

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

The Principles of Vocational Guidance. *C. Burt. Brit. Jour. Psychol., 1924, vol. 14, pp. 336-352.*

Psychological guidance is likely to be most useful when given at the earliest possible age. This is at about the mental age of 14, when the elementary school is changed for industrial employment or for more specialized training. Vocational guidance should be undertaken by the local educational authority, which already possesses records of the medical inspection and of the children's progress at school. Some authorities also provide a school-leaving form, giving a confidential record of the child's characteristics, of his intellectual and practical abilities, his moral character, and the economic and social environment of his home. With the assistance of employment bureaus, the child is recommended for an employment as suitable as can be found, and he is supervised till he reaches the age of 18. The scientific side of the investigation should be attempted by a National Institute, which has branches established in all large towns. Vocational guidance implies a study not only of the characteristics of the individuals to be guided, but also of the characteristics of the employments to which they are to be guided. An inventory should be made of the various employments available in each district, and also a scientific study of the qualities re-

quired for the commoner trades. Persons should be followed up after they have entered the occupation for which they have been recommended.

In making recommendations for vocational guidance, it is desirable to assess the physical and medical qualifications, and the educational attainments, especially general intelligence. In questions of vocational selection, employers should recognize that it is possible to engage an employee who is too intelligent for his job, as well as one who is too dull; therefore each person should be drafted into jobs corresponding as closely as possible to his own level of intelligence. A survey of London schoolchildren shows that they contain less than 1 per 1,000 of the highest grade with mental ratios above 150; 1 to 2 per cent. of children with a ratio of 130–150; 10 per cent. with one of 115–130; 38 per cent. with one of 100–115; 40 per cent. with one of 85–100; 10 per cent. with one of 70–85; and 1 per cent. with one of less than 70.

In assessing vocational capacities, endeavor must be made to estimate the special abilities of the children, but their temperamental qualities are better tested by observation than by experiment.—H. M. V.

THE PRINCIPLES OF VOCATIONAL GUIDANCE. *L. L. Thurstone. Brit. Jour. Psychol., 1924, vol. 14, pp. 353-361.*

The author presents a number of generalizations which he has reached in working with mental tests of various kinds, among which are the following:

One mental test can never serve as a criterion of another mental test. Each test must be checked against the trait (*e.g.*, salesmanship) which the test is intended to measure.

Few vocational test programs are investigated far enough to make them ready for administrative use.

Vocational guidance is more difficult than vocational selection. The vocational counsellor should not make a vocational decision for a student. The student should make that decision for himself.

When starting to devise tests for any special ability, it is better to begin by studying successes and failures than by studying random samples.

Vocational tests in early adolescence have the serious limitation that the interests change markedly during adolescence, though special abilities such as those for mathematics and for music, can probably be safely diagnosed at an early age, and tests for intelligence are fairly stable with increasing age.—H. M. V.

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

COLLIERY PIT-HEAD BATHS. *Indust. Welfare, 1924, vol. 6, pp. 107-108.*

The latest installation of pit-head baths, at the Ashington Collieries, Northumberland, England, is described. They consist of spray baths in separate cubicles. Heating is by 6-inch pipes, which are suspended from the roof principals, the pipes being 9 feet above the floor. A steam pressure of 30 pounds per square inch enables a temperature of 100° F. to be maintained.—H. R. P.

AN UNUSUAL AND EFFECTIVE EMPLOYEE BENEFIT PLAN. *R. N. Phelps. Factory, March, 1924, vol. 32, pp. 332-333, 384.*

The Link-Belt Beneficial Society pays the substantial death claim of $700, which is met by an assessment on the members that is distinct from the regular dues to cover weekly disability benefits. Immediately upon the death of a member, the society advances the sum of $100 to his beneficiary to take care of any current or emergency needs while the $700 is being collected.—M. F. M.

EMPLOYEE HEALTH SERVICE OF STORE. *M. Franklin. Hosp. Management, Jan., 1924, vol. 17, p. 72.*

Fifteen years ago a mutual benefit association was organized in the Jones Store Company of Kansas City, Missouri. The membership is 50 cents a month and $5 is paid for the first week's illness and $10 per week for the next five weeks' illness. No benefits are paid for less than one week's absence, nor are they paid for more than six consecutive weeks, or for more than ten weeks in any one year. A hospital and various

tivities, such as a library and annual outings, are maintained.—H. B. E.

CHANGE HOUSES IN THE LAKE SUPERIOR REGION. *C. E. Kindall. U. S. Bur. Mines, Tech. Paper 289, 1923, pp. 31.*

This paper presents the results of an investigation of change houses at copper and iron mines in the Lake Superior region and describes a model change house designed to meet the peculiar needs of the mining industry in that region.—M. F. M.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

REPORT OF THE COMMITTEE ON TRAUMATIC HERNIA. *W. G. Phippen. Boston Med. and Surg. Jour., Nov. 29, 1923, vol. 189, pp. 848-849.*

This is a report by a committee of the New England Surgical Society.

"1. True traumatic hernia is extremely rare, that is, most hernias are of very gradual development. 2. An individual presenting a claim for hernia in order to have his claim upheld must be able to furnish proof of having had at least 4 of the 6 criteria laid down below. 3. All other cases may be classed as disease either of congenital or occupational origin and are not the results of an individual injury or strain."

The criteria are: 1. Immediate descent of the hernia following the alleged cause, be it injury or strain. 2. Severe pain in the hernial region. 3. Marked prostration. 4. Symptoms of such severity that the individual calls attention to his condition within the first twenty-four hours. 5. No previously existing hernia at the present site. 6. Trauma or strain must be adequate.—B. C.

CANCER OF THE SCROTUM IN A MULE-SPINNER: A TEST CASE. *Lancet, Feb. 2, 1924, vol. 1, p. 252.*

A test case for compensation under the Workmen's Compensation Act, 1906, was recently tried. Counsel submitted that the disease which the applicant had contracted was epithelioma of the scrotum and was caused by mineral oil in the course of his employment. The records of the Manchester Royal Infirmary showed that during the twenty years, 1902 to 1922, 141 patients were treated for this disease: that sixty-nine, or nearly 50 per cent., of these cases occurred in mule-spinners: and that in almost every case the spinners were affected on the left side of the scrotum.

In order to find out why this was so, and why mule-spinners were so prone to this disease, medical men visited various cotton mills to study the conditions under which the men worked. They found that on the machines which the men operated there was a carriage which moved backwards and forwards about 3 feet above the floor, and this had to be followed by the operators. In front of the carriage was a steel bar, which the medical men noticed was always splashed with the mineral oil used for lubrication of the spindles. Threads which were constantly breaking had to be pieced by the operators, who leaned over the carriage, and as they did so the left side of the body constantly came into contact with the steel bar covered with oil. The temperature of the room in which the men worked was high, and the men wore no clothing beyond a pair of trousers and a shirt. Counsel submitted that it was the irritation set up by the mineral oil, combined with that caused by constant friction against the metal bar, that was responsible for the disease.

The disease usually manifests itself by the presence of a small wart, which is frequently malignant from the beginning, and the only successful cure is an operation performed in good time. The applicant in the present case discovered about two years ago that he had a small scrotal growth, which gradually increased in size, and for which, on August 4, 1923, he underwent an operation. A sample of the oil used on the machine, if analyzed, would be shown to be such a mineral oil as was described in the schedule of the Workmen's Compensation Act.

The case, one of considerable importance, was held up on purely technical grounds of legal procedure, but will come before the courts again.—E. L. C.

REHABILITATION OF DISABLED EMPLOYEES

Occupational Therapy Associated with Industrial Injury Service. *C. J. Elsasser. Arch. Occupational Therapy, Feb., 1924, vol. 3, pp. 11-17.*

This is a description of the industrial accident service carried on in California by Drs. French and Early in which occupational therapy plays an important part in the rehabilitation of the patient. It has been proved by statistics covering a number of years that temporary disability periods have been reduced 20 per cent. and that there has been no case of traumatic neurosis. Approximately 600 cases a day are treated in this service and 600 cases receive first-aid each week. A number of illustrative cases are given. Over 30,000 hours were given to occupational therapy by the patients in one year.

Occupational Therapy as Applied to Surgical Cases. *J. D. Adams. Arch. Occupational Therapy, Feb., 1924, vol. 3, pp. 1-10*

The author believes that occupational therapy should be therapeutic rather than commercial in its purpose, and that since it is an adjunct to medical treatment, it should never be applied without a prescription. He describes his own experiences with surgical cases and concludes that when a surgical case which has had good surgical treatment shows impaired function, occupational therapy may be safely applied if the surgeon believes there is a possibility of further improvement by increase of muscle tone and increase of range of motion. If, on the other hand, a case of impaired function is a permanent disability where no hope of improvement can be held out by the surgeon, the patient should be taught a trade, for his case is then one for vocational retraining.—M. F. M.

INDUSTRIAL MORTALITY AND MORBIDITY STATISTICS

Mortality and Psychology among Coal Miners. *E. L. Collis. The Times, Jan. 24, 1924.*

"The accompanying records are of some interest. Information concerning mortality in occupations is only published for the chief coalfields and the last records refer to 1910-12; those for 1920-22 have not yet appeared. The order of the fields, however, when arranged according to mortality, has been much the same for thirty years, and probably has not altered much in the last ten years.

"The psychology of the miners has been tested on three occasions in recent years; if the coalfields are arranged in order according to the existence of dissatisfaction as ascertained by the percentages of 'non placet' votes recorded on each occasion, the orders obtained present a significant similarity to the mortality order. The position of Yorkshire in 1920 may be noted: on this field a strike, which did not affect the rest of the industry, occurred in 1919 and was held to influence the vote of 1920. In 1921 and 1924 the percentages recorded placed this field not far from the position given by mortality.

"The data are in support of the view that the psychology of the coal miner closely reflects the existence of illbeing, that illbeing which finally leads to mortality."

COALFIELD	COMPARATIVE MORTALITY		
	1890–92	1900–02	1910–12
Lancashire	1,236	1,006	941
South Wales	1,322	951	774
Yorkshire	1,051	783	758
Northumberland and Durham	894	763	635
Derbyshire	841	675	591
Nottinghamshire			570

COALFIELD	PERCENTAGE OF MINERS VOTING		
	FOR STRIKE AUGUST, 1920	AGAINST RESUMING WORK JUNE, 1921	AGAINST WAGE AGREEMENT JANUARY, 1924
Lancashire	90.6	89.6	94.3
South Wales	77.9	73.0	89.8
Yorkshire	51.1	65.3	75.1
Northumberland and Durham	69.9	66.7	75.9
Derbyshire	71.8	52.7	76.8
Nottinghamshire	55.1	53.7	69.2

ABSTRACT OF THE LITERATURE
OF
INDUSTRIAL HYGIENE

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GENERAL

SOME PROBLEMS OF FACTORY INSPECTION. *Internat. Labour Rev., March, 1924, vol. 9, pp. 372-386.*

The fifth session of the International Labour Conference, held at Geneva in October, 1923, adopted a series of recommendations on factory inspection.

The evidence before the Conference and its conclusions are well summarized in this article. It determined that "the principle should be laid down and maintained that the employer and the officials of the establishment are responsible for the observance of the law, and are liable to be proceeded against in the event of deliberate violation of or serious negligence in observing the law, without previous warning from the inspector." Diversity of practice was found with regard to an inspector's work; thus, in Great Britain judicial and administrative functions are separated; the inspector can prosecute for breach of the law only before a judicial court—a slow and cumbersome proceeding. In other countries the inspector is part of the police system and has extensive powers for enforcing his authority; he has to interpret the law himself. The Conference in its proposals leans toward the British custom. An interesting recommendation is "that, in view of the difficult scientific and technical questions which arise under the conditions of modern industry in connection with processes involving the use of dangerous materials, the removal of injurious dust and gases, the use of electrical plant and other matters, it is essential that experts having competent medical, engineering, electrical or other scientific training and experience should be employed by the state for dealing with such problems."

The Conference looks benignly upon inspection through insurance agencies, so long as the special officers employed by such organisations are guided by sound principles.

No opinion was expressed upon the advantages or disadvantages of inspectors being permitted to intervene in trade disputes. But the recommendation is made "that, with a view to securing full co-operation of the employers and workers and their respective organisations in promoting a high standard in regard to the conditions affecting the health and safety of the workers, it is desirable that the inspectorate should confer from time to time with the representatives of the employers' and workers' organisations as to the best measures to be taken for this purpose."—E. L. C.

FERTILITY OF MARRIAGE. *T. H. C. Stevenson. Census of England and Wales, 1911, vol. 13, part 2, H. M. Stationery Office, 1923.*

This monumental publication is one of great social and industrial interest. It is by far the most important study of fertility ever undertaken, dealing, as it does, with the fertility of various social classes in England and Wales from the middle of the nineteenth century to 1911. Special statistical methods are pursued for arriving at standardized figures of total fertility (children born per hundred couples) and of effective fertility (children surviving per hundred couples), for which those interested must turn to the original document.

Differences are found in the fertility of social classes—the higher the social standing, the lower is the fertility—but before the birth rate commenced to decline, during the latter half of the last century, these differences were far less pronounced than in recent years. Hence, the failure of the better stock to maintain itself would appear, in the main, to be a new phenomenon.

Particular attention is directed to the influence of the occupation (*a*) of the mother, and (*b*) of the father, upon fertility. Low fertility and high child mortality characterize the bulk of women's occupations. Out of seventy occupational groups only two (brushmakers and costermongers) reached the standard figure for total fertility, and only one (glove makers) for effective fertility. Relatively high child mortality is distinctive of occupational working-class mothers. The loss of the mother's care frequently involves the death of the child, particularly among textile operatives and earthenware makers. Distinctive as is this characteristic, it is most pronounced when the occupation is carried on away from home, and less when carried on at home; for twenty-seven of the former occupational groups, the percentage excess of child mortality averages 49, and for sixteen of the latter, the excess averages 21.

The influence of the father's occupation is brought out by dividing the population into ten groups of equal size graded according to total fertility. Samples chosen from these ten groups are given in Table 1.

TABLE I.—INFLUENCE OF FATHER'S OCCUPATION UPON FERTILITY

Group	Samples of Group	Total Fertility Figure
First (least fertile) 10 per cent.	barristers	165
	doctors	169
	solicitors	173
	clergy	184
Second 10 per cent.	grocers	203
	wool spinners	209
	musicians	217
	cotton weavers	220
Third 10 per cent.	police	234
	barbers	243
	milk sellers	246
	publicans	248
Fourth 10 per cent.	printers	254
	tram drivers	257
	carpenters	262
	plumbers	263
Fifth 10 per cent.	coach makers	268
	coal dealers	271
	hosiery makers	271
	greengrocers	280
Sixth 10 per cent.	tailors	286
	cycle makers	289
	cabinet makers	290
	messengers, porters	292
Seventh 10 per cent.	railway laborers	301
	iron molders	306
	boot makers	308
	masons	312
Eighth 10 per cent.	coopers	320
	potters	325
	quarrymen	327
	boiler makers	328
Ninth 10 per cent.	fishermen	330
	brick makers	339
	navvies	345
	coal-getters	368
Tenth (most fertile) 10 per cent.	shipyard laborers	373
	pig iron manufacture	376
	coal heavers	381
	dock laborers	398

Two broad deductions emerge: (*a*) most of the fertile occupations involve heavy manual labor, and (*b*) an inverse relation seems to exist between brain work and fertility.

A special comparison is presented of the fertility of agriculturists, textile workers, coal miners, and the populations in which

they live. The total fertility of the miner (3.41) is higher than that of the agriculturist (3.07), and of the textile worker (2.04). It is higher than that of the population among whom he lives; the same is true for the agriculturist, who, like the miner, performs heavy manual work, but not for the textile worker, whose physical labor is not pronounced.

Fertility within mining groups is highest where work is heaviest—*i.e.*, at the coal face; other workers below ground have a slightly lower fertility and so have workers on the surface. Nevertheless, the earnings of the coal-getter are rather higher than those of the other two groups; apparently the extra output of physical energy by the coal-getter exerts a greater influence upon fertility than do his wages upon his social status. These three groups of miners show a higher total fertility than mine owners, agents, and managers, but high child mortality modifies this advantage. Hence, the coal miner ranks below the agriculturist in effective fertility, while the textile worker, with an even higher child mortality, has an unusually low figure for effective fertility. A study of fertility by geographical distribution proves that the influence of occupation predominates over that of locality.

This Blue Book provides a mine of information to which social and industrial investigators must for many years to come make constant reference.—E. L. C.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

Cerebral Edema and Headache Following Carbon Monoxid Asphyxia. *H. S. Forbes, S. Cobb, and F. Fremont-Smith. Arch. Neurol. and Psychiat., March, 1924, vol. 11, pp. 264-281.*

This article is summarized as follows:

Carbon monoxide inhalation was found to cause in animals and in man a rise in intracranial pressure. Three conditions were considered which might explain this rise: cerebral congestion, increased secretion of cerebrospinal fluid, and cerebral edema. Cerebral congestion was the first observed and to it were due the sudden rises in pressure recorded by manometer. Of increased secretion of fluid, no evidence was found, though our experiments did not rule it out as a possibility. In regard to cerebral edema, definite evidence in favor of its occurrence was obtained. This evidence consisted chiefly in the following observations:

After prolonged asphyxia a gradual increase in brain bulk was observed through a trephine opening.

This increase persisted after decapitation of the trephined animal. It was therefore a true increase in volume and not due to dilated ventricles distended by fluid, or to vascular congestion.

Intravenous injection of hypertonic saline solution, which was known to cause absorption of water by the blood from the tissues, reduced the increased brain bulk and relieved compression symptoms.

In man, intravenous injection of hypertonic saline solution relieved promptly a stuporous condition, accompanied by an abnormally high spinal fluid pressure and headache, of twenty-four hours' duration, due to asphyxia by illuminating gas.

Histologic study of gassed animals showed no typical picture of cerebral edema. Desiccation experiments suggested the presence of slight edema but were not conclusive.

In animals the early increase in intracranial pressure was accompanied by a dilation of the veins about the optic papilla, and the late increase in brain bulk was accompanied by a striking color change in the fundus from green to orange, due probably to congestion of the smaller vessels of the choroid.

In man the headache following experimental gassing was at its height half an hour after removal from the gas and at this time dilation of the retinal veins and hyperemia of the papilla were at their maximum.—C. K. D.

The Carbon Monoxide Self-Rescuer. *A. C. Fieldner, S. H. Katz, and D. A. Reynolds. U. S. Bur. Mines, Rep. Investigations, Serial No. 2591, April, 1924, pp. 10.*

The "self-rescuers" are pocket-size gas

respirators which protect the wearer from air contaminated with poisonous carbon monoxide gas. "The self-rescuer removes the hazard of carbon monoxide poisoning for one-half hour or more."

Inhaled air passes first through absorbent cotton to remove smoke, then through 14 to 20 mesh calcium chloride to remove moisture, then through "hopcalite" which oxidizes carbon monoxide to carbon dioxide. The inhalation and exhalation valves are made of mica and are seated, by springs, on knife-edge rings.

The efficiency of the mask was tested against 1 per cent. of carbon monoxide in air at rates of flow up to 32 liters per minute. Tests on men and on canaries showed the mask to be satisfactory and to meet the Bureau specifications which are designed to allow an ample factor of safety.

The mask is described in detail with complete photographs and drawings. It can be purchased from the Mine Safety Appliance Company, Pittsburgh.—P. D.

THE INHALATION OF ARSENICAL INSECTICIDE DUSTS. *A. Kelsall and J. H. Campbell. Abstr. as follows from Sci. Agr., 1924, vol. 4, pp. 159-161, in Chem. Abstr., April 10, 1924, vol. 18, p. 1029.*

The amount of actual arsenic inhaled by workers engaged in different positions exposed to arsenic dusts was determined. The arsenic which would have been inhaled was absorbed by a sponge covering the nostrils of workers. Persons operating powder dusters using a Bordeaux dust or a sulphur dust containing 2 per cent. arsenic inhaled 0.02 gm. arsenic in ten-hour periods and when walking in dust clouds inhaled 0.039 gm. and 0.033 gm. When 0.13 gm. is taken as a dangerous dose, the amounts inhaled are not considered dangerous, but it is stated precautions against its inhalation should be taken. —P. D.

THE SYMPTOMS OF LEAD POISONING: THEIR SIGNIFICANCE FOR EARLY DIAGNOSIS AND DIAGNOSIS. *L. Teleky. München. med. Wchnschr., Feb. 29, 1924, vol. 71, pp. 266-269.*

This is a review of the difficulty in distinguishing between lead absorption and intoxication. Teleky studied many workmen for varying periods of time. There is no single symptom of poisoning which is first to appear—some cases show blood changes first, others pallor of the face, and others weakness of the extensor muscles. Stippling appears in pathological quantity only after rapid absorption or liberation of large quantities of lead, or in very susceptible people. Weakness of the extensor muscles appears as the first symptom only when absorption has been very slow and prolonged.

The general appearance of the patient is a very important diagnostic sign. All patients should be excluded from lead exposure who show change in color of the face plus marked stippling of the blood, particularly when either of these, or any other symptom, is very evident.

One must take into account the rapidity of development—the gradual development is less alarming than the sudden appearance of these symptoms.—J. C. A.

DUST HAZARDS AND THEIR EFFECTS

AN INVESTIGATION OF THE DEVASTATING STARCH DUST EXPLOSION AT PEKIN, ILLINOIS. *D. J. Price, H. R. Brown, and P. W. Edwards. Chem. and Metall. Engin., April 14, 1924, vol. 30, pp. 579-584.*

This report of the Bureau of Chemistry, United States Department of Agriculture, describes the devastating explosion at Pekin, Illinois, and recommends measures to lessen the dangers from dust explosions.

The plant at Pekin is owned and operated by the Corn Products Refining Company and is one of several belonging to this company for the manufacture and production of starch and by-products from corn.

The cause of the explosion and the resulting fire, according to the authors, was an overheated bearing which ignited wooden parts nearby. The heat therefrom started the fire and explosion. This particular bearing was near the tipple where dried starch was dumped into hoppers—an operation which caused the liberation of dust clouds.

A number of specific recommendations are

made by the authors and include methods of constructing buildings and lubricating bearings.—P. D.

INVESTIGATIONS ON AIR FILTERS. *H. Baer. Abstr. as follows from Z. Ver. deut. Ing., 1923, vol. 67, pp. 970-972, in Chem. Abstr., March 10, 1924, vol. 18, p. 601.*

For qualitative tests of air before and after filtering glass plates covered with a sticky material were used. In the Kapnograph, paper with a sticky surface was driven by clockwork, and currents of filtered and unfiltered air were directed against portions of it simultaneously. For quantitative work the air was filtered and the increase in weight of the filtering thimble determined. Care must be used in drying and weighing the filter; an oil-heated bath (110°) with a current of clean air passing through the filter gave best results. For determining the efficiency of commercial filtering media, air is drawn through a sample stretched over the end of a conical pipe, the drop in pressure measured to obtain filter resistance, and the volume of air passing through determined by Pitot tube and micromanometer; samples of air are drawn through filtering thimbles placed before and after the filtering medium, and then through gas meters. Quantitative determinations of dust in air or gas demand most painstaking care, as well as scientific ability.—P. D.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

TUBERCULOSIS AMONG NATIVE LABOUR IN THE SOUTH AFRICAN GOLD MINES. *A. J. Orenstein. Trop. Dis. Bull., March, 1924, vol. 21, pp. 239-240.*

"As some proof that our methods of combating tuberculosis on the mines are not altogether unsatisfactory, I may point to the fact that in our Group of Mines, with an average of about 80,000 natives, the mortality from tuberculosis, which in 1911 was 3.7 per 1,000, has gradually declined since then, and in 1922 was 0.78 per 1,000. When I assumed my present appointment in 1914 the mortality was 2.6 per 1,000. Furthermore, in 1916 Drs. Watkins-Pitchford, Stewart and myself undertook an investigation covering some 400 natives, selected at random from two of our mines, with a view of enquiring into the prevalence of undetected tuberculosis among the natives on the mines. We found only one case with open tuberculosis among these 400, and this man was known to be a sufferer from tuberculosis, and was retained on the mine merely because he was an old employee and had no other place to go to. He was employed as a watchman."

REPORT OF SIX CASES OF CUTANEOUS ANTHRAX TREATED BY THE LOCAL AND GENERAL ADMINISTRATION OF ANTI-ANTHRAX SERUM. *J. C. Regan and C. Regan. Am. Jour. Med. Sciences, Feb., 1924, vol. 167, pp. 255-266.*

The authors conclude their article as follows:

The local and general administration of anti-anthrax serum is the most logical, effective and specific method of treatment for cutaneous anthrax that can be employed. It possesses less objectionable features than, and none of the dangers of, the methods previously in common use. It may be relied on to cure every case of malignant pustule if the patient is not suffering from some chronic debilitating disease and comes under observation before septicemia has already developed. Even in the latter instances, it is the one method that offers the slightest chance of a success and therefore should always be tried.

Two cases treated by this method have been previously reported; in the present paper six other cases are included, all of whom recovered. We have, in addition, records of six more patients who were treated in a similar manner and in whom recovery ensued. This makes a total of fourteen recoveries with serum therapy. We have had two failures in our experience, both patients coming under observation within less than forty-eight hours of death and with an anthrax septicemia already well developed on their admission to the hospital.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

MATHEMATICAL VALUES OF THE SNELLEN NOTATIONS. *A. C. Snell. Am. Jour. Ophth., April, 1924, vol. 7, pp. 277-287.*

"The Snellen notation of visual acuity was not intended for a fractional expression of the proportion of full vision found. Its use in that sense gives a false impression. A series of test type, arranged on the plan of a unit of difference between the different sizes of the letters, is inferior to one arranged with the unit of proportion of one size to the letters next larger or smaller. For industrial examination of impairment of vision an assumed zero and maximum of full vision are necessary. Those recommended are 20/32 for the maximum and 20/320 for the zero of industrial vision."

DETECTION AND LOCALIZATION OF INTRAOCULAR FOREIGN BODIES. *G. S. Dixon. Am. Jour. Ophth., March, 1924, vol. 7, pp. 206-208.*

The character of the accident causing the injury throws important light on the case. The greater number of magnetic foreign bodies come from the use of hammers, especially in attempting to remove hoops from barrels or boxes. A broken needle rarely remains in the eye. Glass can be recognized by the X-ray, if of low penetrating power. Cases are cited in which the source of the foreign body could not be ascertained. In some cases of cataract an unsuspected foreign body was present.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

INDUSTRIAL ACCIDENTS INCREASE IN 1923. *Nat. Safety News, April, 1924, vol. 9, pp. 19-20.*

This article is a summary of information collected by the National Safety Council from state industrial commissions, insurance companies, and individual companies.

LABOR TURNOVER AND ITS RELATION TO ACCIDENTS. *B. J. Mullaney. Nat. Safety News, April, 1924, vol. 9, p. 35.*

The Peoples Gas Light and Coke Company of Chicago has nearly 2,000 employees in the mechanical class. In 1921 the total number of accidents to men in this class was 300, and the labor turnover, 225 per cent. In 1922, the total number of accidents was 243, the labor turnover, 182 per cent. In 1923, the number of accidents was 212, and the labor turnover, 162 per cent. The decrease in accidents from 1921 to 1923 was 29 per cent; the decrease in labor turnover, 28 per cent.—M. F. M.

WHERE SERVICE IS FIRST AND SAFETY ALWAYS. *G. E. Wallis. Nat. Safety News, March, 1924, vol. 9, pp. 5-8.*

In 1920 accidents to employees of the Texas Power and Light Company reached a high peak with a frequency rate of 58.6, a severity rate of 20.9, and a total compensation cost of $60,000, with seven accidental fatalities. The company accordingly decided to organize a safety department. In 1921 the accident rate fell to 24.7, the severity rate to 15.9, and the cost of compensation to $35,000, with five accidental fatalities. In 1923, the year of greatest expansion and number of hours worked, the frequency rate went up, but the severity rate fell to 1.58. The total accident expense was $12,000, and there was no fatal or serious accident to an employee.

This was accomplished largely by overcoming the personal factor. Motion pictures of safe and unsafe practices make a strong appeal, especially when safety slogans are put into a title under the picture of a well-known foreman or employee. Foremen are held responsible for accidents occurring in work under their direction unless investigation proves the cause to have been beyond their control. The fact that a penalty varying from reprimand to discharge always results from a serious accident keeps them interested in enforcing safe conditions and safety regulations.—M. F. M.

SILK STOCKINGS, SANITATION AND SAFETY. *J. M. Sandel. Nat. Safety News, March, 1924, vol. 9, pp. 15-17.*

This article describes the ventilating and air-filtering apparatus and the safeguards for machinery used by the Phoenix Hosiery Company.

According to the chief engineer of the

Company, the manufacture of hosiery is not a hazardous business. There are few serious accidents, but numerous minor ones that do not cause loss of time.—M. F. M.

Warehouse and Shipping Rooms. *Safe Practices Pamphlet No. 59, Nat. Safety News, March, 1924, vol. 9, pp. 49-58.*

"Although warehouses and shipping rooms are not usually looked upon as hazardous places, they have been the scenes of many accidents," the pamphlet states. "These departments involve a large amount of hand labor under changing and often disorderly conditions."

The pamphlet treats in detail of buildings and platforms, hazards of packing materials, hazards of packing, construction of wooden packages, safe practices inside buildings, and equipment used in shipping rooms.

Numerous industrial firms have aided the National Safety Council in the preparation of this pamphlet, and it is profusely illustrated with pictures of safety methods used by these companies.

How Lift Trucks Aid in Safe Handling of Material. *A. L. Lewis. Nat. Safety News, April, 1924, vol. 9, pp. 21-22.*

Designing the Mechanical Safeguard. *F. S. Benedict. Nat. Safety News, April, 1924, vol. 9, pp. 25-26.*

Designing the Punch Press Die. *G. S. Thompson. Nat. Safety News, March, 1924, vol. 9, pp. 9-10.*

INDUSTRIAL SURGERY

Serious Head Injuries. *A. S. Chittenden. Indust. Doctor, March, 1924, vol. 2, p. 44.*

This article deals with the treatment of those head injuries which are accompanied by sudden or briefly delayed unconsciousness. Because the chief factor in the morbidity or death is intracranial hemorrhage with cerebral compression, the author recommends lumbar puncture employed as early as possible and repeated at intervals of two or four hours. In certain cases the author suggests cisternal puncture. Where there is delayed unconsciousness and a clear spinal fluid, decompression at the site of injury is required. The chief value of prompt puncture is that it reduces the incidence of "concussion" and helps considerably in ruling out or determining intracranial hemorrhage. —H. B. E.

Treatment of Fractures from an Industrial Standpoint. *E. W. Ryerson. Jour. Bone and Joint Surg., Jan., 1924, vol. 6, pp. 188-191.*

The author concludes his paper as follows: The object of this paper is to encourage the wider use of physiotherapeutic methods and also the use of splints and apparatus in suitable cases, rather than the more convenient and less expensive plaster of Paris circular casts. It is realized that in many cases, especially after open operation, a plaster of Paris dressing affords a simplicity and security which cannot well be substituted. It should be pointed out, however, that in oblique or incompletely reduced fractures of the shaft of the femur, a long plaster of Paris spica is the most unreliable and imperfect method of attempted fixation that can be applied. Inside of it, over-riding and angulation can occur with ease and with very little external evidence, so that it is sometimes appalling to examine the roentgenograms taken a week or two, or a month or two, after the surgeon has completed what seemed to be an excellent reduction.

Fundamental Facts Relative to the Study of the Vertebrae in Industrial Accident Cases. *A. W. George and R. D. Leonard. Radiology, April, 1924, vol. 2, pp. 197-213.*

This article is very valuable. It gives the results of an eleven years' study of a large number of cases of injury and disease of the vertebra referred to the authors by various insurance companies. The conclusions which the authors have derived from their work may profitably be told in their own words.

"We have tried to emphasize the fact that there is a normal standard vertebra, the normal limits, however, being somewhat variable and influenced by age, sex and occupa-

tion. We have attempted to enumerate some of these normal variations, particularly those due to age and occupation. Secondly, we have considered the abnormal variations, consisting of congenital deformities, deformities due to trauma and deformities due to disease. Particular attention has been paid to a differential diagnosis between changes due to trauma and those due to disease.

"Under the topic of disease, we have discussed the so-called arthritic changes.

"We appreciate full well, in the analysis of the X-ray evidence of variations in the appearance of the spine, that this paper is very rudimentary. Many of the questions discussed we have not been able to answer conclusively, but our purpose has been accomplished if we can sufficiently arouse interest among the profession at large to continue a standardized study of the classification of vertebral disorders. We shall rest content if, to any extent, this paper will be productive of a common terminology and a common viewpoint of the intricate changes which the X-ray reveals in the vertebrae."

Nineteen illustrations of X-ray plates, excellent in detail, illustrate very well the points discussed.—H. B. E.

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

THE FATIGUE ELEMENT IN ACCIDENT PREVENTION. *W. Baum. Nat. Safety News, March, 1924, vol. 9, pp. 32-33.*

The graphs presented in this article show the relation between accident frequency and days of the week and hours of the day. Accidents are most frequent between 11 and 12 o'clock in the morning and between 4 and 5 o'clock in the afternoon. On Monday the number of accidents is higher than on Tuesday and Wednesday; toward the end of the week the accident curve rises sharply, reaching its maximum on Saturday (full day).

The danger of accidents from fatigue may be minimized by the introduction of rest pauses, by the shortening of the working day, and by general improvements in working conditions.—M. F. M.

TWO STUDIES ON REST PAUSES IN INDUSTRY. *Indust. Fatigue Res. Board, Rep. No. 25, H. M. Stationery Office, 1924, pp. 34.*

In the first part of this report H. M. Vernon and T. Bedford describe their observations on the influence of the introduction of rest pauses in light repetitive work. Output was determined for several months before and after the introduction of the rests, but it was found to be difficult to get thoroughly reliable results, owing to the existence of other variable factors which influenced output. In order to eliminate the effects of practice, the observations were confined to piece-rate workers of at least two years' experience. In spite of this experience their output was not quite steady, but continued to improve slowly. Lighting is another variable factor, as the artificial lighting employed during part of the working hours in winter sometimes reduces output. The results obtained, however, show that after making full allowance for the influence of such factors, there was a genuine improvement of output after the introduction of the rests.

A group of seventeen girls engaged in labeling small packages were tested for 20 weeks before the rest, and for 17 weeks after a 10 minutes' pause was allowed in the middle of the 4½ hour morning spell of work. Their output slowly improved, and in the last 6 weeks of the rest period it was 13 per cent. greater than in the pre-rest period, in spite of the loss of 2 per cent. of working time. A group of six girls engaged in pressing grooves in rectangular pieces of cardboard were tested for 9 weeks before the change and for 22 weeks after, and they showed a 5 per cent. improvement, while a group of thirteen girls engaged in tying packages showed an 8 per cent. improvement. At a boot and shoe factory, a group of five women engaged in sewing the uppers of boots were tested for a 32 week period, and they showed an 11 per cent. improvement after the introduction of a 10 minute pause in their 4¾ hour morning spell of work. A group of seven girls engaged in assembling the components of bicycle chains were tested for a 14 month period, and after the introduction of a 5 minute pause during each hour of their 8½ hour working day, their

output showed a 13 per cent. improvement in spite of the loss of 7 per cent. of their working time. It is to be noted that the full effect of introducing a rest pause took 2½ to 6 months to establish itself.

The effect of rest pauses varies with the type of work, being most advantageous in work dependent chiefly on the human element, and least so in that dependent chiefly on the mechanical element. It was found difficult to get adequate proof of this statement, but the results obtained with the four groups of girls studied at a handkerchief factory supported it. They were all given a 7 minute rest in the morning spell of work, and the group of six girls engaged in the purely manual operation of folding handkerchiefs showed a 4.4 per cent. improvement of output. On the other hand, the twenty-nine hem-stitchers whose sewing-machine work was largely mechanical in nature showed a 3.4 per cent. *reduction* of output. In between came the group of eight ironers, with a 0.4 per cent. improvement, and the group of six calenderers, with a 4.0 per cent. improvement.

The effect of rest pauses varies with the individual worker, being greatest in the slowest workers, and smallest in the quickest. For instance, on splitting up the group of seventeen labelers above mentioned, it was found that the five quickest girls improved 8 per cent. as the result of the rest, the six intermediate girls improved 13 per cent., while the six slowest girls improved 17 per cent. The other groups of girls tested showed a similar though less marked correspondence between speed of production and rest pause effect. Data obtained with the group of hem-stitchers suggest that the poor output of the slowest workers was due largely to fatigue. These women usually worked a 48 hour week, but sometimes went on to short time, and worked only 24 hours. In consequence, their hourly rate of production improved, but while that of the nine quickest women rose 9 per cent., that of the eleven intermediate women rose 13 per cent., and that of the nine slowest women, 21 per cent.

Quite apart from regularized rest pauses, the workers always get some rests by voluntary stoppages from work. Also they get changes of occupation, such as fetching more material or sorting the articles made, and these may act almost as advantageously as complete cessation from work. The duration of these unofficial "rests" was determined by keeping groups of workers under close observation for four or more days. Groups of men engaged in heel building, and of girls engaged in labeling, carton making, shoe sewing, soldering, and other operations, were studied. It was found that on an average they took less than 1 minute per hour of voluntary rests, while the changes from their chief occupation lasted about 4 minutes per hour. The rests kept very steady right through the working day (except in the first and last few minutes of the work spells), and so did the hourly rate of production.

In the second part of the report S. Wyatt and A. D. Ogden describe the results of laboratory experiments in which a subject performed easy examples of addition. The results obtained, after some weeks of practice, show a rapid reduction of speed during the first 45 minutes of the 2½ hour morning spell of work, followed by a steady speed. In the 2½ hour afternoon spell, output fell for the first 1¾ hours, and then rose gradually. When a 15 minute rest was introduced in the middle of each work spell, the rate of production rose 22 per cent. As compared with the non-rest observations, it increased 12 to 20 per cent. in the 1¼ hours before the rest was taken, and 20 to 24 per cent. in the 1¼ hours after. The introduction of two rest pauses of 7½ minutes in each spell was not quite so beneficial as the single pause of 15 minutes.

When a 15 minute rest pause was introduced in the middle of a 2 hour work spell devoted to simple addition, it was found that the effect produced depended on the way in which the rest was spent. Observations on four subjects showed that when it was spent in walking, the average improvement was 1.5 per cent.; when spent in tea or music it was 3 to 4 per cent.; but when complete relaxation in easy chairs was taken, it amounted to 9 per cent. Hence, to be really effective a rest pause must provide opportunity for complete relaxation, and it is questionable if this is possible under a piece-rate system of payment.—H. M. V.

On the Extent and Effects of Variety in Repetitive Work. *Indust. Fatigue Res. Board, Rep. No. 26, H. M. Stationery Office, 1924, pp. 38.*

The first part of the report is by H. M. Vernon, who describes the degree of variety found in practice in repetitive industrial work. In order to investigate the degree of variety in repetitive industrial occupations, groups of workers were kept under close observation at a number of factories where boots and shoes, tin canisters, handkerchiefs, polishes and other articles were manufactured. Fifty processes were studied, and note was made of the time spent on the chief manual or machine operation, on subsidiary operations, and on walking about to carry material. The duration of the work cycle was determined, and was found to last only one to four seconds, in many cases. The workers who sat at their work were observed to get four breaks per hour, on an average, during half of which they were standing or walking, while the standing workers got five breaks, during most of which they were walking about carrying material. The breaks lasted in the aggregate about seven minutes per hour.

The degree of variety in many industrial occupations can be increased by giving facilities for changes of posture during the work. In many tin canister operations the work can be performed either when sitting or standing, but the workers often neglect their opportunities of making postural changes. For instance, the women engaged on a punching process at one factory were observed to stand for 18 per cent. of their time, while those on the same process at another factory did not stand at all. Again, a number of girls engaged in soap packing could sit or stand, as they pleased, but they exercised their option most capriciously, without any system.

The second part of the report is contributed by S. Wyatt and A. D. Ogden and is concerned with the effect of changes in activity. It is based on industrial investigation and laboratory experiments. The industrial investigation was concerned with the processes in cleaning, filling, padding, capping and labeling small bottles. The results show that too many changes in the form of activity are undesirable and have an adverse effect on production. The unproductive time on a typical day amounts approximately to 18 per cent., and, in addition, a further decrease in the rate of working occurs because of the unfavorable effect of the interruptions upon the swing of work. When the form of activity was changed at intervals of approximately half an hour, an increase in output of 17 to 20 per cent. was observed in the case of two operatives. When these operatives worked at the same process throughout the day, the increase in output observed amounted to 15 and 35 per cent. respectively, but the days of uniform activity were much disliked by the operatives

In the laboratory experiments three kinds of activity were employed, simple addition, mechanical computation, and muscular work. Changes in the form of activity introduced at fifty minute intervals in two daily spells of two and one-half hours each were found to be much superior to unvaried spells of equal length. The increase in total output varied from 2.4 to 24.2 per cent., the number of errors was decreased by from 9.2 to 55.1 per cent., and the subjects found the varied days much more congenial than the days of uniform activity. Thus, it appears uneconomical to maintain the same form of unbroken activity throughout the spell of work, yet too many changes in the form of activity are equally undesirable. It accordingly appears that for each form of activity an optimum duration exists, which will probably be dependent upon the type of work and the individual peculiarities of the worker.—E. L. C.

HEAT, COLD AND HUMIDITY

NOTE ON THE EFFECT OF EXTERNAL TEMPERATURE ON THE CIRCULATION IN MAN. *J. Barcroft and E. K. Marshall. Abstr. as follows from Jour. Physiol., 1923, vol. 58, pp. 145-155 in Med. Science, April, 1924, vol. 10, p. 43.*

The authors have investigated the change in their own "minute volume" consequent upon exposure to a low or high temperature. The resting "minute volume" was determined after sitting for fifteen minutes in a room at 15°C. After fifteen minutes' exposure to a temperature of –1°C., when the tendency to shiver was well marked, the "minute volume" was always found to be increased; coincident with this was a commensurate rise in metabolism. The pulse rate was reduced, and consequently the sys-

tolic output of the heart per beat was considerably increased. After exposure to a temperature of 40°C. for about one hour, the "minute volume" increased, on some occasions, by about 3 to 4 liters. There was, however, no commensurate rise in metabolism. The amount of blood going through the parts of the body other than the skin was apparently little changed, so that the rise in "minute volume" represents within rough limits the increase in cutaneous circulation consequent upon the high temperature.

SOME EFFECTS ON MAN OF HIGH TEMPERATURES. *W. J. McConnell and R. R. Sayers. U. S. Bur. Mines, Rep. Investigations, Serial No. 2584, March, 1924, pp. 13.*

Further work with human subjects, on the effects of abnormally high temperatures and humidities. (See previous papers by the authors and by Houghten and Yagloglou, abstracted in THIS JOUR., 1923-1924, vol. 5.)

Among the authors' conclusions are: There is inability of the body to compensate for still-air effective temperatures; length of exposure is of more importance than the severity of the conditions; the pulse rate is the most significant index of distress in all subjects; and a close parallelism exists between rectal temperatures and temperatures of the environment. Loss in body weight and increase in blood count (due to concentration of body fluids) indicate that these effects vary with the length of exposure and severity of the conditions.

While the paper repeats a great deal of the matter already published by this group, several new charts are given and programs of future work are suggested. In the abstractor's opinion, the present paper is by no means up to the high standard which this group has established in their previous publications in this important field. It is none the less a valuable contribution.—P. D.

AIR MOTION—HIGH TEMPERATURES AND VARIOUS HUMIDITIES—REACTIONS ON HUMAN BEINGS. *W. J. McConnell, F. C. Houghten, and C. P. Yagloglou. Jour. Am. Soc. Heating and Ventil. Eng., March, 1924, vol. 30, pp. 199-224.*

This is a continuation of the work by these same authors, using substantially the same equipment as in their papers abstracted previously. (See THIS JOUR., 1923-1924, vol. 5, Abstr. Section, p. 67; *ibid.*, vol. 6, p. 23.)

All tests described in this paper were made at dry bulb or effective temperatures of 85° F. or over. While the same might be said of previous papers by these authors, this series of tests is unique both in the thoroughness with which their results were recorded and in the perseverance of the subjects in remaining in the test rooms under conditions which, in everyday life, would be considered utterly intolerable. Because of this spirit of perseverance the authors were enabled to plot a curve of average human endurance in hours against effective temperature as high as 114.4° F.

The numerous tables and the exceptionally complete sets of curves render the paper unsuited to abstracting but admirable for bringing out many points of interest.

The authors conclude their paper as follows:

"1. Air motion exerts a cooling effect on the human body in atmospheres where the temperature is less than that of the body; in temperatures above that of the body air motion increases the discomfort, but the rate of air change in reactions cannot be doubled by doubling the velocity of the air.

"2. Within the range of the experiments no appreciable change in the period of endurance resulted from air motion as indicated by the series of tests in still and in moving air.

"3. The pulse-rate appears to be the best index to the severity of the discomfort.

"4. The correlation between the pulse frequency and body temperature is not constant.

"5. The systolic blood pressure increases on exposure to high temperature, while the diastolic pressure decreases, and frequently becomes a negative quantity.

"6. The peripheral blood vessels dilate on exposure to high temperature.

"7. Respirations are increased in rate and depth after removal from a hot atmosphere to a cooler one.

"8. The loss in weight which occurs after exposure to high temperatures is not permanent.

"9. Exposure to high temperatures did not cause albuminuria in any case of the subjects of these experiments.

"10. Special studies of certain physiological reactions due to high temperatures are reported in separate articles."—P. D.

WOMEN AND CHILDREN IN INDUSTRY

THE WORKING MOTHER IN FRANCE. *Internat. Labour Office, Indust. and Labour Information, Feb. 18, 1924, vol. 9, p. 28.*

The French law regulating the employment of mothers has been modified so as to bring the period of absence during which a woman's place must be kept open up to twelve weeks. It also provides that she may not be dismissed even if she is absent for fifteen weeks if her absence is due to an illness which is caused by pregnancy or confinement.

Frenchwomen without means are given maternity allowances during the rest period before and after confinement. If the mother nurses the infant herself, she is paid a daily bonus for twelve months after confinement. —M. F. M.

MINORS IN AUTOMOBILE AND METAL-MANUFACTURING INDUSTRIES IN MICHIGAN. *U. S. Dept. Labor, Children's Bur., Pub. No. 126, 1923, pp. 131.*

In the representative metal-manufacturing factories of Michigan included in this survey, 11 per cent. of all the employees were under 21 years of age. Of these, 99 per cent. were over 16 and about two-thirds were between 19 and 21. They were most numerously employed as machine operators, laborers, and helpers, inspectors, stock and tool-crib workers, and assemblers.

The boys outnumbered the girls eight to one. Most of the girls worked as inspectors, trimmers, assemblers of small parts, sewing-machine operators, stock and tool-crib workers, and core makers. Wages were lower for girls than for boys, even in the same occupations.

Fifteen per cent. of the minors for whom information as to hours of work was secured had worked over fifty-four hours a week. Hours of labor for minors over 18 are not restricted in Michigan.

The median weekly wage was $27; the median hourly wage, 60 cents. Nearly one-fourth of the workers earned $35 or over a week, but this often represented long hours.

Two-thirds of the minors had completed the eighth or a higher grade, and 30 per cent. had taken high school courses.

A large proportion of the industrial accidents to minors occur in the metal-working industries. Efforts toward accident prevention existed in all the factories visited, though in different states of development.—M. F. M.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

DAYLIGHTING FROM WINDOWS. *H. H. Higbie and G. W. Younglove. Tr. Illuminating Engin. Soc., March, 1924, vol. 19, pp. 235-268.*

The purpose of this paper is to present a considerable amount of experimental data covering various points of practical importance and great interest with respect to daylighting of interiors, upon which actual and detailed quantitative information appears to be meager. The investigations which yielded these data are still in progress, so that some tentative conclusions reached herein may have to be changed when additional information later becomes available. The data presented cover actual utilization coefficient for typical daylight illuminations, together with curves and coefficients representing distribution of the daylight under a variety of conditions; there are also data on the effect of width of mullions or columns between windows upon distribution of illumination in the room, on the relative effect and efficiency of light from various portions of the window area, on the effect of various methods of controlling the light from windows by means of shades and blinds, and on the effect of dirt accumulations on windows.—P. D.

THE DETERMINATION OF DAYLIGHT INTENSITY AT A WINDOW OPENING. *H. H. Kimball. Tr. Illuminating Engin. Soc., March, 1924, vol. 19, pp. 217-234.*

The paper briefly reviews the photometric measurements of sky brightness and the determinations of the intensity of daylight on horizontal, vertical, and sloping surfaces, which are given in full in the reports of the

Committee for 1921 and 1922. Most of the measurements were made in a comparatively smoke-free suburb of Washington, but some were made in a smoky section of the city of Chicago.

A method of determining the extent of the shading of window openings by neighboring buildings, first given in the report for 1921, is reviewed and extended. The advantage of laying out cities so that the streets run NE-SW and NW-SE instead of E-W and N-S, is pointed out.

Determinations of the reflecting power of surfaces of different kinds and photometric measurements of their brightness under both cloudy and clear-sky conditions are also summarized.

The data thus brought together, namely, on the brightness of the sky, the intensity of daylight, the shading effect of nearby buildings and other objects, and the reflecting power, or the brightness, of different surfaces, are utilized to compute the intensity of daylight at a window opening under given conditions.—P. D.

SOME PRINCIPLES GOVERNING THE PROPER UTILIZATION OF THE LIGHT OF DAY IN ROOF FENESTRATION. *W. S. Brown. Tr. Illuminating Engin. Soc., March, 1924, vol. 19, pp. 269-287.*

The light of day is usually considered a wholesome and vital requirement in our buildings. But it often needs modification —especially with regard to direct sunlight.

Sources of daylight with which the architect has to work are briefly described with regard to their intensity, direction, and seasonal and diurnal variation.

The usual requirements for natural illumination are outlined, and some of the general principles governing the utilization of the latter in roof fenestration are set forth —the entering daylight being analyzed as consisting of:

(*a*) Sunlight directly admitted to the working space.

(*b*) Light from the sky only directly admitted to the working space.

(*c*) Combined light from sun and sky (or from portions of the sky alone) diffusely reflected from adjacent interior or exterior surfaces.

Methods of evaluating each are described, and examples are worked out for certain usual types of roof fenestration—these being divided into the two following general classes:

Class 1. The *one way type*, in which the directly entering light comes largely from a single half or side of the "sky dome."

Class 2. The *two way or opposed type*, in which the directly entering light comes from both halves or sides of the "sky dome." Horizontal roof openings may be considered as an extreme of Class 2.

Some of the advantages and disadvantages of each class are summarized.—P. D.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

THE EFFECT OF PHYSICAL EXAMINATION ON THE HEALTH AND WELFARE OF EMPLOYEES. *L. I. Dublin. Indust. Doctor, March, 1924, vol. 2, pp. 46-48.*

In this article Dr. Dublin describes the results which the Metropolitan Life Insurance Company has obtained by requiring physical examinations of its employees. "We have cut down the cases of overweight; we have helped to cure diseases of the kidneys; we have improved defective eyesight through the prescription of proper glasses and fitting them correctly. Dental Hygiene has been instituted and each employee has the benefit of prophylactic dental work every six months." The physical examinations have disclosed numerous defects which have been removed or alleviated in many cases.

The author also describes the policy of the Metropolitan Life Insurance Company in providing for the physical examination of large groups of its policyholders. During 1923 about 60,000 policyholders took advantage of these physical examinations.

Dr. Dublin quotes statistics showing that this policy has resulted in the definite saving of life. He also states that the opportunity for policyholders to receive physical examinations has proved popular and that the benefits derived are generally appreciated. He suggests that it would pay mutual benefit associations to utilize this means of keeping

their members healthy and efficient.—H. B. E.

MEDICAL SERVICE FOR 437 EMPLOYEES. *M. Vanderbeck. Hosp. Management, March, 1924, vol. 17, p. 70.*

The hospital of the Ingersoll Milling Machine Company has a first-aid department with a registered nurse in charge and a company surgeon on call. The department serves an average payroll of 437 men. About 308 new minor surgical cases are cared for each month, eye injuries being the most serious problem. The nurse and physician help in checking up absentees.—H. B. E.

MEDICAL SERVICE IN AN ENGINEERING WORKS. *W. M. Johnston. Indust. Welfare, March, 1924, vol. 6, pp. 69-71, 101-102.*

Dr. Johnston outlines the methods employed by the medical department of the Ford Motor Company (England), Limited. As far as the industrial worker is concerned, practically the only way of applying prevention is to bring medical service into the workshop. All applicants for employment at the Manchester works of the Ford Motor Company are referred to the medical department for examination. No employee may leave the works because of illness, or resume work after illness without passing through the medical department. As soon as employees have recovered sufficiently to attend the works after serious accidents or illness, they are given light work until they are fit to undertake their ordinary duties.—H. R. P.

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

VOCATIONAL GUIDANCE AND MENTAL HEALTH. *G. K. Pratt. News Bulletin of the Bureau of Vocational Information, March 1, 1924, vol. 2, pp. 35 and 39.*

"From the point of view of preserving mental health a vocational guidance program must offer more than an inventory of the candidate's intellectual abilities and disabilities. It requires an intimate study of that particular individual's personality (not merely as one of a large group or class but as an isolated individual). It also requires that we learn something of his character make-up and, perhaps most of all, of his emotional life and past experiences. Failing to make such a balanced and well rounded study, mental shipwreck is certain to occur in a sufficiently large number of cases to warrant our pausing and questioning the usefulness of present methods.

"Finally, the statement should be repeated that when mental shipwreck does arise in such cases, the faulty vocational selection is merely a precipitating cause and not the entire *casus belli*. The tendency to such a breakdown in most cases has been present since birth and lay dormant until the individual found himself placed in a situation that made greater demands on him for adjustment than he was capable of offering."—H. B. E.

ONE INDUSTRY'S ATTITUDE TOWARD SELECTION BY MENTAL LEVELS. *C. M. Wienand. Jour. Educational Psychol., March, 1924, vol. 15, pp. 180-182.*

This article is a report of an interview with one of the chief executives of a large corporation of national scope. It shows the attitude of this corporation toward intelligence tests for the selection of employees at the present time. In substance it is this: The company cannot afford to take the chance, because of the reaction on the part of the employees. In actual practice intelligence testing will not be feasible because it disregards the human element and considers the individual only as an increment to the group. The executive quoted prefers selection through a process of training in company schools.—H. B. E.

SHOULD PERSONNEL WORK FOLLOW A WORKER HOME? *M. R. Lott. Factory, May, 1924, vol. 32, pp. 673-674.*

The author gives as his opinion that personnel work is more than "an inside the plant job." At the present time recognition of the importance of the human factor in industry has resulted in satisfactory hygienic working conditions, the adoption of means to prevent accidents, and the provision of wage incentives. The home conditions of the

worker, however, have not commonly been made the subject of the employer's interest. It is the feeling of the writer of this paper that a genuine interest in the personal affairs of the worker will bring about better relations between the management and the employees. To indicate the soundness of his point of view, he cites two interesting cases which are said to be typical of the type of problem that comes up before the personnel administrator for solution and which may be considered "not strictly company business."

The first case deals with a minor executive who was anxious to purchase a home for his family. This employee was considered a very difficult person to handle, and now and then the question of discharge had come up, but because the factory manager felt that with proper adjustment he would develop into a first-class executive, he was retained. A permanent adjustment was brought about finally by assisting the man in the purchase of his home through advice and funds, with the result that he is now considered a very satisfactory and efficient employee.

The second case deals with an engineman in the boiler room who one day was found intoxicated. The case was investigated and it was found that this employee had numerous home difficulties which made him despondent, with the result that he yielded to an old temptation for strong liquor. Although he was not allowed to return to his old job, it was realized that a helping hand was needed and the company continued its interest in him. After a while an opportunity came and he was returned to his old job.—H. B. E.

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

Housing for Employees in Finland. *U. S. Month. Labor Rev., Dec., 1923, vol. 17, pp. 1378-1380.*

Vocational and Other Educational Training by Employers in Finland. *Ibid., pp. 1413-1414.*

Welfare Work for Employees in Finland. *Ibid., p. 1415.*

The data for these three reports have been taken from the Social Tidskrift, 1923, Nos. 4, 6, 7, and 8, published by the Social Ministry of Finland.

The first deals with housing. "The investigation covered 150 large industrial enterprises operating 222 factories. Of the 150 industries investigated, 133 had built houses for their employees. Of a total of 57,171 workers, 18,645, or 32.6 per cent., lived in houses furnished by the employer. This figure is twice that for all industry generally, showing that the large industrial undertakings have been more active than the rest of industry in meeting their employees' housing needs." The houses vary as to type and sanitation.

The second article deals with vocational and other educational training by employers in Finland. It is stated that "employers are gradually beginning to recognize the importance of vocational instruction for young persons." In 1921 laws were passed reorganizing the school system and providing for vocational training. Mention is made of a large industry which provides a four year course in vocational training.

The third article deals with welfare work for employees in Finland. Among various types of welfare work, the most important are co-operative stores, factory kitchens, hospitals and dispensaries, vocational training for young workers, lecture courses, and day nurseries. Some of the factories employ welfare workers.—H. B. E.

REHABILITATION OF DISABLED EMPLOYEES

Occupational Therapy and Post-Hospital Employment. *S. C. Johnson. Mod. Hosp., Feb., 1924, vol. 22, pp. 196-197.*

"Not until we have a complete plan in operation which begins with occupational therapy and leads through curative workshops to established industry which will include sheltered industries, can we hope to give the sub-standard worker his dues, nor make much progress with industrial rehabilitation for the sick and otherwise handicapped person."

PHYSIOTHERAPY IN INDUSTRIAL ACCIDENT WORK. *H. E. Stewart. Jour. Am. Assn. for Medico-Physical Res., Feb., 1924, vol. 1, pp. 105-106.*

This paper is concerned with the after-care of industrial accidents. The author states that after the initial surgical treatment the indications are usually:

(*a*) To increase the capillary blood supply to the injured tissues, thereby accelerating directly the repair processes.

(*b*) To prevent organization of extravasated blood and lymph and to hasten its absorption.

(*c*) To prevent or remove joint, muscle and tendon adhesions.

(*d*) To remove venous and lymphatic stasis which in itself impedes circulation and causes pain by pressure on sensory nerve termini.

(*e*) To remove muscle spasticity.

(*f*) To strengthen atrophic muscles following disuse or motor nerve injury.

(*g*) To minimize any infection which the trauma has induced directly or indirectly in the tissues.

(*h*) To reduce, soften and stretch scar tissue.

(*i*) To promote skin regeneration after extensive surface injury including burns.

The author recommends for these indications the use of different forms of physiotherapy. For instance, to increase capillary circulation he recommends the use of radiant light and heat, superheated dry air, the paraffin bath, high frequency and other similar surface applications. For detailed directions and recommendations the reader is referred to the original article.—H. B. E.

THE SEQUEL TO DISABLEMENT. *J. C. Faries. Am. Jour. Surg., Feb., 1924, vol. 38, pp. 24-25.*

Recovery is the main concern of the physician, while the work of rehabilitation must be done by the layman. At the present time thirty-eight states have some machinery for helping the man who has been disabled in industry. Ill-advised surgery, which could be avoided if surgeons knew the requirements of limb-makers and the industrial possibilities open to the maimed man, may hamper the work of rehabilitation.—M. F. M.

CINEMATIZATION OF ARTIFICIAL HAND. *E. Platou. Abstr. as follows from Acta Chirurgica Scandinavica, Dec. 22, 1923, vol. 56, p. 331, in Jour. Am. Med. Assn., Feb. 16, 1924, vol. 82, p. 589.*

Platou gives an illustrated description of the sixteen cases in which he made one or two canals in the stump out of a bridge of skin, and thus allowed volitional control of the artificial hand. Twelve have used their prostheses for from three months to three years, and in only one instance have the canals been tender. The muscular power of the canals has increased in all but two, and ten have expressed their satisfaction with the cinematization. A working claw can be used for severe labor and then be changed for the artificial hand at will, as one changes a garment.—K. R. D.

INDUSTRIAL MORTALITY AND MORBIDITY STATISTICS

HEALTH IN THE PRINTING TRADES. *Internat. Labour Office, Indust. and Labour Information, March 3, 1924, vol. 9, pp. 24-25.*

The experience of the International Typographic Union shows that the mortality rate for printers has declined from 13.2 per thousand for the period 1911 to 1919 to 11.1 per thousand for the period 1920 to 1923. The average age at death has increased from 49.1 years in 1911 to 54.4 in 1923. Considering the high average age, a mortality rate of 11.1 may be taken as a sign of healthy conditions on the whole and further reduction appears to call for attention to personal rather than to industrial hygiene.

Information relative to mortality from lead poisoning reveals death as a practically accidental occurrence.—M. F. M.

ABSTRACT OF THE LITERATURE

OF

INDUSTRIAL HYGIENE

VOLUME VI SEPTEMBER, 1924 NUMBER 5

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GENERAL

FOURTH ANNUAL REPORT OF INDUSTRIAL FATIGUE RESEARCH BOARD TO 31ST DECEMBER, 1923 (INCLUDING PERSONAL CONTRIBUTIONS FROM INVESTIGATORS). *H. M. Stationery Office, 1924, pp. 54.*

During 1923 investigative work in industries was curtailed owing to abnormal conditions associated with depression in trade. The opportunity has been taken to tighten up the organization of the Board. Meanwhile research has been and is being carried on in the laboratory to test results already obtained by observations made under industrial conditions. Details of the organization and the work now in progress are given in the first part of the report; they establish that there is a wide and increasing field for investigation.

The second part of the report contains contributions from investigators. Here Miss May Smith speaks of the psychological problems which confront an investigator making observations in factories; she points out the different psychological attributes of both managers and operatives, and how these attributes may affect the output as well as the influences which the investigator is trying to evaluate. The next article is by E. Farmer on the method of grouping by differential tests. He discusses the mental and physical disabilities of persons engaged in industry and the means by which they may be measured. The methods pursued by the Board may seem tedious and laborious, but the results should be finally fundamental and of value to the community. The third contribution, by S. Wyatt, deals with the training of industrial operatives. Mr. Wyatt is concerned mainly with the textile industry and puts forward an extremely cogent case for the establishment of industrial training before workers enter the factories. The last of the articles is by H. M. Vernon, who discusses the use and significance of the kata-thermometer. The function of the kata-thermometer is to measure the cooling power of the atmosphere. He puts in a plea for the provision of more adequate changing rooms so that special clothing can be used during hours of work.—E. L. C.

REPORTS OF GERMAN FACTORY INSPECTORS FOR 1922. *U. S. Month. Labor Rev., Dec., 1923, vol. 17, pp. 1263-1274.*

"The annual reports of the German factory inspectors have always been read with interest by social economists and all circles interested in the protection of workers because they contain the personal observations and experiences of officials entrusted with the practical enforcement of protective labor laws."

General economic conditions have been fairly well maintained in spite of the depre-

ciation of the mark, because the German workers "have shown a steadfast will to work." Although there is accelerated industrial activity, temporary dismissals of workers occur at times. Special problems, such as the hours of labor in bakeries and confectioneries; the protection of women during confinement; rest periods for nursing mothers; the conduct of juvenile workers at work, at school, and in their spare time; the influence of the wage system on the accident hazard in dangerous occupations; the hygiene of workers in establishments dealing in rags, raw materials and scrap metal; and the education of workers have been investigated. The eight-hour day is generally enforced for industrial workers, although considerable overtime work is done. The value of rest periods does not seem to be appreciated by adult workers in many cases.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

BENZENE POISONING. *Teleky and E. Weiner. Abstr. as follows from Klin. Wchnschr., Feb. 5, 1924, vol. 3, p. 226, in Jour. Am. Med. Assn., March 15, 1924, vol. 82, p. 931.*

Teleky and Weiner found that lymphocytosis (over 40 per cent.) was the most typical sign of chronic benzene poisoning. Erythrocytes, hemoglobin, and the platelets were subnormal.—K. R. D.

CANCER PRODUCING FACTOR IN TAR. *E. L. Kennaway. Abstr. as follows from Brit. Med. Jour., March 29, 1924, p. 564, in Jour. Am. Med. Assn., May 10, 1924, vol. 82, p. 1572.*

Kennaway presents the evidence, from both the industrial and experimental sources, which indicates the presence or absence of carcinogenic power in different fractions obtained from coal tar and in the pure substances isolated from it. The attempts to find the cancer producing substance among the known constituents of coal tar have given negative results. Anthracene, phenanthrene, chrysene, picene, retene, truxene, acenaphthene, fluorene, acridine, carbazole, aniline, benzene, toluene and xylene have been excluded by experimental tests; and either the experimental or industrial evidence, or both of these, is against the importance of naphthalene, the acids, bases and other nitrogenous compounds, paraffins, olefines and naphthenes. It now seems not unlikely that this substance is an unknown compound, which is unstable and present in amounts perhaps as small as those of the vitamins in foods; as in the case of some hormones, its identification may be long delayed even when very concentrated preparations can be obtained. The substances which are known to be present in coal tar have been isolated because they are specially abundant, or stable, or capable of forming well-defined compounds; the unknown substances are unknown because they have not these properties, and the cancer producing substance may well be among them.—K. R. D.

TAR CANCER. *J. Fabry. Abstr. as follows from Med. Klin., Jan. 6, 1924, vol. 20, p. 13, in Jour. Am. Med. Assn., Feb. 23, 1924, vol. 82, p. 666.*

Fabry describes warts in men who are employed in pressing hot tar and coal dust into bricks. The warts are perfectly smooth even when the cancer begins to develop.—K. R. D.

EPITHELIOMA OF THE SKIN AFTER PROLONGED EXPOSURE TO CREOSOTE. *H. A. Cookson. Abstr. as follows from Brit. Med. Jour., March 1, 1924, p. 368, in Jour. Am. Med. Assn., April 12, 1924, vol. 82, pp. 1228-1229.*

Cookson cites an instance of epithelioma of the skin of the right hand in a worker exposed for many years to creosote. He had also a few warty growths on the left arm, one of which presented evidence pointing to possible early malignant changes. Cookson believes it to be fairly certain that creosote was the cause of the malignant growth and subsequent death of the man. The internal organs showed numerous secondary deposits of cancer. A large deposit involving the wall of the heart projected into its interior. The glands in the right armpit were enlarged and invaded by malignant disease.—K. R. D.

ABSTRACT OF THE LITERATURE

OF

INDUSTRIAL HYGIENE

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GENERAL

THE PLACE OF INDUSTRIAL HYGIENE IN THE GENERAL SCHEME OF DISEASE PREVENTION. *A. J. Lanza. Supplement to Med. Jour. Australia, May 10, 1924, vol. 1, pp. 304-306.*

The author holds that industrial hygiene, apart from its routine functions which are both preventive and remedial, offers a substantial increase in our knowledge of the physical status of the community and of the incidence and etiology of disease and thus provides an intelligent basis for further disease prevention.—E. L. C.

OBSERVATIONS ON INDUSTRIAL MEDICINE IN AUSTRALIA AND OTHER COUNTRIES. *D. G. Robertson. Supplement to Med. Jour. Australia, May 10, 1924, vol. 1, pp. 310-311.*

The thesis is maintained that the economic loss resulting from the illness of wage-earners is enormous. It is no exaggeration to say that disabling illness is responsible for the loss of six days per worker per annum or, if one considers that there are at least 1,500,000 persons gainfully employed in Australia, a total loss of at least 9,000,000 working-days per annum. A saving of even one-tenth of this by the adoption of more scientific methods of disease control would more than repay the expenditure involved.—E. L. C.

GLIMPSES INTO A TRAM MAN'S LIFE WITH SPECIAL REGARD TO OCCUPATIONAL DISEASES. *C. A. Ellis. Supplement to Med. Jour. Australia, May 10, 1924, vol. 1, pp. 308-310.*

The author examined over 3,000 men employed on the tramways of Melbourne and describes their work. He finds that men on the cable system do more arduous work and are more exposed to weather, while on the electric system the men are more protected. These variations are reflected in the health of the men. Taken as a whole Dr. Ellis considers that the tramway occupation is from a medical point of view a healthy one.—E. L. C.

NIGHT WORK IN BAKERIES. *Internat. Labour Rev., April, 1924, vol. 9, pp. 558-572; May, 1924, 680-707.*

These two articles deal at some length with the question of night work in bakeries. This subject has been discussed by the trade concerned for several years past. In these articles arguments for and against prohibiting night work are put forward. One of the main arguments against night work is that it affects the health and general well-being of the baker and his family. Unfortunately, no sure evidence in support of this has been adduced. At the same time a definite tendency toward prohibition is being manifested in many countries. The need for this matter to be handled by the International Labour Office is not so great as in the case of many other industries. Baking is essentially an internal trade, which is not affected by the output abroad. Each country must settle the question for itself. The articles contain much interesting information, and conclude with a useful table setting forth the legislation on the matter in various countries.—E. L. C.

EMPIRE MINING AND METALLURGICAL CONGRESS, LONDON, JUNE 3 TO JUNE 6, 1924.

This congress, which had for its chief objects the discussion of papers dealing with the scientific, technical, and economic problems connected with the development of the mineral resources of the empire, was held at Wembley. It was decided by the conference at the end of the meeting to form an empire council of mining and metallurgical institutions to promote intercommunication between the various interests, to create and maintain a higher standard of technical efficiency, and to convene further congresses. At a dinner held in the Guildhall, Mr. Saunders, the delegate from the American Bureau of Mines, expressed the hope that America would be asked to join.

The conference was opened by the president, Viscount Long of Wraxhall, with a paper on the mineral resources of the empire. Papers dealing with the mineral resources of the dominions were submitted by the Institutes of Canada, Australia, and South Africa.

Of interest to the medical profession was a series of papers under the heading of "Researches on Safety Problems in Mining" introduced by Sir Edward Troup (Chairman of the Safety in Mines Research Board) who described the work of the Safety in Mines Research Board, the Eskmeals Station under Dr. Wheeler, the five special committees, and other bodies. He dealt with the problem of underground explosions and the varied aspects from which this important problem was being attacked; the character of coal dust, its physical and chemical properties; the character of the atmosphere, its composition, temperature, and quiescence or turbulence; the character of the source of ignition—whether it is short or prolonged, and whether it is accompanied by a compression wave or not—and the possibility of ignition from a compression wave alone.

"Coal Mining Explosives" by Colonel Sir Frederic Nathan summarized the work of the Explosives in Mines Research Committee. This work has been carried out by means of gallery tests, by the examination of inflammable mixtures of fire damp and air, and coal dust and air, and the ignition of these mixtures. Much spade work has been done, but Sir Frederic Nathan does not think it desirable or possible to draw any definite conclusions yet; he is hopeful that sound foundations have been laid and that the problems are much nearer solution.

The third paper was "Spontaneous Combustion of Coal" by Dr. Haldane. Dr. Haldane made a delightful introduction to the subject by the study of the spontaneous combustion of hay ricks. This is due to the action of micro-organisms in the first instance; but this action soon stops from the death of the organisms, which cannot stand a higher

temperature than 160° C. A second action then begins, a chemical change which is greatly accelerated by the preliminary heating. If the stack is large enough, heat is generated by what Dr. Haldane calls the "avalanche" effect to raise the temperature of the stack to the ignition point. The center of the stack becomes heated and by convection the temperature extends upwards in an increasing degree—each portion of hay becomes hotter than the one below. If heat is not lost from the surface, and this is chiefly a question of the size of the stack, a sufficiently high temperature is reached. A stack of coal fires in the same way. It is probable that pyrites plays an important part in the heating of coal, comparable to that played by the organisms in the hay stack. In the crystalline form pyrites remains unaffected but if broken up oxidizes rapidly. The underground combustion of coal is due to the existence of broken coal which allows the passage of air. Risk of underground fires is diminished by avoiding the crushing of coal and by the close packing of the goaf.

"The Explosion of Firedamp" by Professor H. B. Dixon described the method of estimating the velocity of the propagation of flame through a mixture of gases.

In "Coal Dust Explosions" Mr. W. Mason discussed the importance of the cloud of dust produced by the preliminary ignition. Mr. Mason has carried out experiments with the addition of incombustible dust.

	Velocity of Flame ft. per sec.	*Maximum Pressure lbs. per sq. in.*
Pure coal dust	1,700	50.0
Shale and coal dust	185	4.8

In "Electricity in Mines" Mr. Robert Nelson pointed out that although electricity was the latest handmaiden to be used in mines the progress made was already very considerable. The death rate per 100,000 H.P. motors installed during 1919 to 1921 inclusive was 1.7. The recent developments in the improvement of casings of electrical appliances have made the danger from ignition practically negligible.

"Miners' Safety Lamps" by Dr. Wheeler gave a summary of the work of the Committee on Miners' Lamps and dealt largely with the question of the safety of the gauzes used in lamps. The factor of safety is too high, and it is possible by using a more open gauze to increase the candle-power of the oil safety lamp from 0.5 to 0.93. The limit of safety is a mesh containing 0.50 square inch per square inch of gauze. An ordinary safety lamp can detect 1 per cent. of fire damp and special lamps one-half of 1 per cent. The oil lamp is therefore quite efficient as a gas detector. It is possible that a gas mantle capable of standing rough usage may be made. No further improvement in the use of combustion tube lamps is to be expected. Acetylene lamps might be used if it were possible to devise a means of automatically relighting the lamp when it became extinguished. The use of electric lamps has increased from 10,727 in 1912 to 327,929 in 1923. Future developments are probably in the use of pillarless lamps or the introduction of universal lighting at the coal face.

The paper on "Physiological Problems in Mining" by Dr. J. S. Haldane, whose lifelong researches on the subject entitle him to speak with the greatest authority, contained in a condensed form the latest knowledge of the subject. Dr. Haldane divided his paper into four parts.

I. Gases Met with in the Mine.—Firedamp (CH_4) formed by slow process of the coal substance is stored up in a state of solid solution or adsorption. The gas is of chief importance on account of the explosions caused by it. It has no known positive ill effects when breathed and seems to be of physiological importance only in so far as it displaces the oxygen from the air. It is extremely dangerous to advance into mine air containing more than 50 per cent. of fire damp on account of the oxygen deficiency.

Black damp is the gaseous residue left when various substances, such as coal, timber, pyrites or organic matter, are oxidized and consists chiefly of nitrogen and from 5 to 15 per cent. of carbon dioxide. Black damp is found in all mines and even in shallow wells. The direct danger from it is due to the lowering of the oxygen percentage in the air breathed. Black damp is formed in porous strata or unventilated spaces and the gas may issue in enormous quantities when the barometer falls.

Carbon dioxide. Outbursts of this gas occur after blasting when large quantities of the gas which have been adsorbed in the

coal are liberated. In small quantities the gas stimulates breathing.

Carbon monoxide occurs in large amounts wherever combustion or thermal dissociation of carbonaceous material occurs in the absence of sufficient oxygen; 95 per cent. of the deaths in colliery explosions are due to carbon monoxide poisoning; 0.02 per cent. causes headache and 0.2 per cent. will probably cause death. The onset of symptoms depends on the amount of gas present and on the amount of work being done. There is no truth in the old idea that carbon monoxide forms such a stable compound in the blood that it remains permanently. When air free from the gas is breathed, the compound is dissociated and in the course of several hours has all been breathed out. Recovery from carbon monoxide poisoning may be hastened by the administration of oxygen with 5 per cent. of carbon dioxide. A less bulky and simpler method is to use air and carbon dioxide. Dr. Haldane has devised an apparatus in which one small cylinder of liquid carbon dioxide may be used with air.

Nitrous fumes are the result of slow combustion of high explosives. Very few symptoms are noticed at the time but in a few hours acute bronchopneumonia, which is often fatal, sets in. Treatment consists in the continuous inhalation of oxygen.

Sulphuretted hydrogen is one of the constituents of afterdamp; 0.2 per cent. will cause death in two minutes; in less amount the gas acts as an irritant producing painful inflammation of the eyes and bronchopneumonia.

II. Heat in Mines.—The body temperature is constantly being regulated by a delicate adjustment of heat production and heat loss. The adjustment is brought about by variation in the flow of blood through the skin under normal conditions but in high temperatures the regulation results from the powerful action of evaporation from the skin. For this to be effective it is essential that water should evaporate freely from the skin. If air is saturated with moisture at body temperature, there can be no cooling action. The air of the mine must be kept dry. If air is motionless the rate of evaporation will be slow—it is important to change the air rapidly. With a given air current it is the actual wet bulb temperature that matters; with a given wet bulb temperature (below body temperature) it is the air current that matters. The readings of the wet kata-thermometer give an admirable measure of the maximum possible rate of heat loss when the body is making full use of its available resources. A miner will stop work if his temperature rises very slightly above normal, as he has found by experience that he must not allow his temperature to rise if he is to earn his living.

"The whole problem of keeping the temperature and moisture in the air at such a standard that full work is possible seems to me an economic one rather than one of health and safety." Dr. Haldane referred to the work on the "Control of Atmospheric Conditions in Hot and Deep Mines" (see THIS JOUR., vol. 6, Abstr. Section, p. 24). Professor Moss has shown that a miner may lose 6½ pounds of sweat in an hour if hard pressed. This leads to a loss of chlorides in the blood and is accompanied by excessive fatigue and severe cramps. Men working in hot air drink water in excess—they sweat profusely and pass little urine. If given water containing 0.25 per cent. of salt, all the symptoms are prevented or relieved when present.

III. Dust in Mines.—Fine dust is carried to the alveoli and is removed by the lining cells of that structure which engulf the particles and cast themselves off to be excreted as the "black spit" of miners. The shale dust used for stone dusting, although it contains 35 per cent. of free silica, seems to be harmless. There is no evidence that coal miners as a class suffer from the inhalation of dust. Pure quartz or true ganister is always dangerous but with an admixture of "country rock" in the first case or fire clay in the second, as Collis has shown, the dust is no longer dangerous. It is probable that the explanation of this is that the crystalline dusts by reason of their inertness, impenetrability, and insolubility do not stimulate the alveolar cells but the addition of a non-crystalline (colloidal) body provides the necessary stimulus and both dusts are removed at the same time.

IV. Underground Infections.—Skin infections are common and call for adequate first-aid arrangements. Ankylostomiasis may be prevented by simple sanitary measures

which prevent pollution of the ground.

The discussion on Dr. Haldane's paper was carried on by Dr. Irvine of South Africa and Professor Chapman of Sydney, both of whom acknowledged their indebtedness to Dr. Haldane's work. Both speakers laid stress on the importance of physical examination before employment, and Dr. Irvine stated that as a result of this examination there had been a fall in the accident rate. He sounded a note of warning to those miners who came to the Rand from overseas—the physical examination before employment was a severe one and many men were left stranded without employment because they had failed to pass the physical tests. Dr. Irvine thought that miners were more subject to fibrosis of the lung than Dr. Haldane's paper led one to suppose but did not think that this fibrosis proceeded to tuberculosis. Professor Chapman also laid stress on the physical examination of miners and gave an account of his investigation on the miners at Broken Hill Mine.—T. L. L.

Working Conditions of Japanese Workers. *U. S. Month. Labor Rev., March, 1924, vol. 18, pp. 198-199.*

The mining industry employs a larger proportion of workers than any other single industry in Japan. In June, 1921, approximately 330,000 were employed in this industry, 80,000 being women.

The accident rate is much higher than in factories. In the year 1919, the frequency rate in the larger factories was 291 per 1,000 workers; while the rate among the miners was 472 per 1,000 workers. In the coal mining industry alone the rate was 548.

In spite of the dangerous character of the work, miners receive somewhat lower wages than factory workers. They are employed an average of ten hours on underground work and twelve hours on surface work.

The wretched living and working conditions of the miners have created a tendency toward acts of violence which are violently suppressed, with the result that the evils against which they are aimed are intensified. Of recent years the miners have adopted the more peaceful and effective methods of the factory workers and are organized into a trade union called "The Whole of Japan Miners' General Association."—H. B. E.

Annual Report of the Chief Inspector of Factories and Workshops for the Year 1923. *H. M. Stationery Office, 1924, pp. 129. Cmd. 2165.*

Improvement continues to be made in the conditions of labor and in the premises where it is conducted. The number of factories has again increased—from 137,858 to 139,920; and again the number of workshops has decreased—from 145,684 to 140,850. This is due not so much to conversion into factories as to the closing up of small rural premises.

Evidence is given of the success of the safety-first movement—an accident frequency rate reduced in four years from 32.3 to 23.6, and a severity rate from 1.4 to 0.8; a percentage rate reduced from 10s. per £100 wages in 1913 to 2s. 8d. in 1922; nevertheless, the movement is stated to be spreading only slowly. The lathe caused a larger total of accidents than any other type of mechanism, and of the total number of accidents due to lathes, over 13 per cent. were eye injuries, an essentially preventable type of accident.

The replacement of natural grindstones by mechanical means continues and with it elimination of dangerous dust in the cutlery trade. New methods of ventilation are reported which in one case maintained a working temperature of 64° F. with an outside shade temperature of 92° F. The use of prismatic glass, ridged vertically at angles of 30°, or 45°, or 60° as preferred, in windows is reported to throw light effectively across rooms 80 feet wide.

Hours of work appear to have become settled at the forty-four-hour and forty-eight-hour week; employers appreciate that overtime does not pay, and workers show a reluctance to adopt it even occasionally. The one-break day and five-day week continue to extend in practice and popularity; the pre-breakfast period has been abolished almost everywhere. The two-shift system remains on trial; it is playing a part in fostering certain industries by reducing production costs, but general opinion is still divided—some workers have accepted it with enthusiasm, others regard it with dislike.

Women have now returned to women's industries, and few remain in trades for which wartime experience showed them well fitted.

Provision of welfare accommodation, in order to comply with statutory orders, has

extended. But voluntary welfare is covering a much wider sphere; here where works committees are live and active, welfare lives and flourishes. The movement has invaded the large cotton mills, and there remain few which are now entirely without provision for meals; in this industry welfare provision is practically never found without a welfare supervisor, making her own experiments and managing her own department.

Taken as a whole the main body of the report tells of steady progress made, notwithstanding the depressed state of industry.—E. L. C.

Report of Senior Medical Inspector. *Ann. Rep. Chief Inspect. Factories and Workshops for 1923. H. M. Stationery Office, 1924, pp. 60-81. Cmd. 2165.*

The number of instances of the chief industrial diseases which must be notified are stated by Dr. T. M. Legge to have increased in number—lead poisoning from 247 to 337, epitheliomatous ulceration from 32 to 58, and chrome ulceration from 42 to 58; anthrax has remained stationary at 46. The advent of broadcasting with a demand for electric accumulators led to an increase of 63 cases of plumbism in this industry, while shipbreaking, another developing industry with risk from burning off paint with the oxyacetylene flame, accounted for most of the remaining increase in cases. The occurrence of a few cases of epithelioma among men exposed to arsenic in sheep dip is told of, and information is given regarding serotal cancer among mule-spinners originating from spindle oil, usually composed of shale oil or American oil.

An interesting account, with detailed chemical analyses, is given of poisoning from arseniuretted hydrogen generated by the action of rain water on dross in a refining foundry. The anthrax disinfection station at Liverpool is said to be fully employed with wool, and the question of how to disinfect horsehair is under consideration; low pressure current steam is stated to be efficient in Germany.

A fatality from inhaling fumes of cadmium is reported, while other men affected suffered from symptoms resembling brass founders' ague (due to zinc fumes). Cadmium and zinc are closely allied metals, but cadmium is the more toxic. Dr. E. L. Middleton investigated the possible re-entry of dust removed from workplaces by exhaust installations and found here a real danger; he makes useful observations on mechanical systems of exhaust applied to flint dust: (*a*) the velocity of the air current on the intake side must not be too great; (*b*) fine particles must be brought to rest either by filtration or by settling; (*c*) the effluent duct should open 20 feet above the nearest inlet to a workplace, preferably after passing over a water surface in a chamber. As a result of a further inquiry Dr. Middleton concludes that the danger from quartz particles can be reduced by inducing clumping such as results if sufficient moisture, together with particles of plastic clay, is present. Further details are given of certain cases of manganese dioxide poisoning (already reported in This Jour., 1923-1924, vol. 5, Abstr. Section, p. 4).

The results of inspecting first-aid and ambulance provisions are stated; in 43 per cent. of the works the maintenance was unsatisfactory, while in certain areas septic poisoning was far too prevalent, amounting to 7.3 per cent. of all reported accidents in one, to 8.4 per cent. in another, and to 14.2 per cent. in a third.—E. L. C.

The Development of Facilities for the Utilisation of Workers' Leisure. *Internat. Labour Conference, Sixth Session, Rep. 1, June, 1924, pp. 112.*

The proposed recommendation, based in nearly all cases on the opinion of the majority of the governments expressed in answer to a questionnaire, covers the following guiding principles:

1. In order to insure that workers shall have undiminished enjoyment of their hours of leisure, the Conference expresses the hope that workers will appreciate the value of the spare time afforded them and that employers will pay wages sufficient to obviate the necessity for employees to seek work in spare time. It recommends that spare time be made as continuous as possible and that well-conceived facilities for transportation be provided.

2. Attention is drawn to the importance of proper housing conditions, public baths, and legislative or private action against the misuse of alcohol.

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3. The Conference points out the need of co-ordination of effort and study of special requirements on the part of the many institutions which provide facilities for workers to use in their spare time. It especially recommends those having as their object the improvement of the workers' domestic economy and family life, the development of physical health and strength, and the encouragement of technical and general education.

4. The necessity of safeguarding individual freedom is stressed.

5. The Conference invites the International Labour Office to keep up to date information concerning the use of spare time and to publish regularly accounts of action taken and results obtained in different countries. —P. K. C.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

AN ADDRESS ON THE NATURE OF CANCER AND THE RELATION OF LONGEVITY, PLUMBISM AND PREVENTIVE MEASURES TO THE MORTALITY RATE OF THIS DISEASE. *W. B. Bell. Pub. Health, June, 1924, vol. 37, pp. 217-223.*

The writer after discussing generally the death rate from cancer advances the idea that a contra-condition exists between lead poisoning and cancer. The evidence in favor is, however, not of much value. Appeal is made in support to certain occupational mortality data. These data, however, have since been shown (*Lancet*, June 14, 1924, p. 1239) to give no support to the theory put forward. Further reference to the matter is, therefore, unnecessary.—E. L. C.

CIRCULATORY SYSTEM

OBSERVATIONS ON THE EFFORT SYNDROME. *T. K. Boney. Jour. Royal Army Med. Corps, May, 1924, p. 347.*

During and shortly after the war many thousands of men suffered from disordered action of the heart. This condition was generally accepted as being disclosed, but not created, by the war. The writer is not able to say whether, per thousand of strength, the number of men troubled with this complaint now in peacetime is less than the number affected during the stress and hardships of actual warfare. Today height, weight, age limit and period of training for the recruit have been reduced and the load carried by the soldier tends to be increased.

Boney regards this "effort syndrome" as being due to some early disability, such as a severe illness in childhood. The toxic factor has ceased to exist and therefore is not discoverable. Patient inquiry will, however, elicit the fact that although little inconvenience has been noticed, a slight shortness of breath on exertion has been experienced. For this reason the recruit has avoided hard games and has led a sedentary life. In the second group of sufferers this "effort syndrome"—shortness of breath, D. S. A., etc. —is generally due to the direct toxins of acute rheumatism, pneumonia, or severe influenza. In the third group it is supposed to have followed some strain or overexertion. The writer places the number in this last group at about 20 per cent. of the total. He says that these cases are difficult to explain and that at the present time no competent observer regards physical strain as the sole responsible agent.

The treatment of these patients is most unsatisfactory. It is almost impossible to restore the physical and mental fitness suitable for a soldier. In spite of the best treatment, disability always remains latent and the associated stigmata remain. It is a common experience that persons who suffer from this trouble vary greatly during the day in their response to exercise tests; at one period their tolerance response will be normal, at another period much below par.

Boney says that in these people the psychic factors are unduly prominent and are easily called into play. Two symptoms generally present in this condition are tremor and vasomotor instability such as cold or damp, often bluish hands. A "lowered exercise tolerance" is found in that shadowy borderland between health and disease. In civil life these sufferers may be suitably placed, but when

they appear in the services, their presence opens up questions of grave importance.—R. P. W.

RESPIRATORY SYSTEM

COMMON COLDS. *A. T. Lytle. Indust. Doctor, April, 1924, vol. 2, pp. 51-56.*

In this article Dr. Lytle attempts to establish the importance of the common cold as a problem for research. He discusses the etiology of the common cold and mentions the fact that there are "two active and opposing schools, the hygienic and the microbial." He feels that both factors play a part in causing colds and stresses the importance of colds in the causation of more serious and permanent pathological conditions. In relation to tuberculosis he quotes Fisher who says, "First fatigue, then colds, then tuberculosis, then death." Arteriosclerosis is also included as one of the end results of colds.

The treatment and management of common colds is divided into local and constitutional, and the author describes the various types of treatment that are in common use at the present time. The most interesting part of the paper is the author's personal experience with stock vaccine inoculations consisting of killed bacteria of numerous strains of micrococci, Friedländer bacilli, pneumococci, streptococci, pseudo-diphtheria bacilli, and staphylococci. He reports very satisfactory results from the use of vaccine as a prophylactic or an abortive agent.—H. B. E.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

MULTIPLE NEURITIS FOLLOWING CARBON MONOXID POISONING. *G. Wilson and N. W. Winkleman. Jour. Am. Med. Assn., May 3, 1924, vol. 82, pp. 1407-1410.*

The authors report three cases, two with necropsy, of patients with multiple neuritis following carbon monoxide poisoning. The clinical picture of multiple neuritis was unusual in that the deep reflexes were increased—an increase due in all probability to involvement of the globus pallidus or of the cortex or of both. The person who has a combination of both conditions—disease of the basal ganglia or cortex and of the peripheral nerves—will show either no alteration or an exaggeration of the deep reflexes, unless the peripheral nerves are greatly affected. Reports of pathological findings and illustrations of histological sections of the affected nerves accompany the article.—K. R. D.

TESTS OF A COMMERCIAL SOLUTION USED TO REDUCE THE HAZARD OF CO POISONING IN GARAGES. *A. C. Fieldner and W. P. Yant. U. S. Bur. Mines, Rep. Investigations, Serial No. 2594, April, 1924, pp. 4.*

The "compound" does not absorb carbon monoxide from garage atmospheres, consequently the spraying of this solution around garages does not decrease the hazard or danger of poisoning from the inhalation of exhaust gases from automobiles.

A NEW REAGENT FOR DETECTING CARBON MONOXIDE. *A. Damiens. Abstr. as follows from Compt. rend., 1924, vol. 178, pp. 849-852, in Chem. Abstr., June 10, 1924, vol. 18, p. 1630.*

By moistening Cu_2O with a little water and adding sulphuric acid in small portions, it is possible to prepare Cu_2SO_4 which is fairly stable in concentrated sulphuric acid. A 5 per cent. solution (by vol.) of this reagent in concentrated sulphuric acid is an efficient absorbent for carbon monoxide. The compound $Cu_2SO_4.2CO$ appears to be formed. It absorbs oxygen slowly and also C_2H_4 and C_2H_2 but does not absorb N_2, CH_4, or H_2. The Cu_2SO_4 is brownish red in color but the carbon monoxide compound is nearly white. When the reagent is nearly saturated with carbon monoxide, it begins to show an appreciable vapor pressure so that in using it in gas analysis it is advisable to treat finally with fresh reagent to make sure that the absorption is complete.—P. D.

GAS MASKS FOR CHEMICAL PLANTS. *Nat. Safety News, April, 1924, vol. 9, p. 41.*

A NOTE ON THE PREVENTION OF LEAD POISONING IN CERTAIN RUBBER-WORKING INDUSTRIES. *L. Greenburg. U. S. Pub. Health Rep., June 27, 1924, vol. 39, pp. 1567-1568.*

Many rubber-working industries use lead compounds to accelerate the vulcanizing process. In some cases, substances of the nature of petrolatum are also used to give the final product a desired texture.

To obviate the lead dust hazard in such a plant it was recommended that the litharge and petrolatum be prepared as a salve, at a point removed from all other workers, and be added in this form to the "batch" in the required amounts.

It is understood that some plants cannot make use of such a method.—P. K. C.

SULPHURETTED HYDROGEN POISONING: WITH SPECIAL REFERENCES TO EYE SYMPTOMS—"PINK EYE." *H. P. Clark. Med. Jour. Australia, May 3, 1924, vol. 1, pp. 439-440.*

The author discusses the effect of inhaling sulphuretted hydrogen gas in the local mines. He points out that the gas acts through the blood stream, producing headache, smarting of the eyes, confusion of the mind, and loss of power over the limbs. The individual develops a drunken gait and may pass on to a stage of fatal insensibility. All symptoms clear up after twenty-four hours' absence from the pit. Prevention lies in improved ventilation in the workings.—E. L. C.

BLOOD ANOMALIES IN RADIOLOGISTS AND IN PERSONS EMPLOYED IN RADIOLOGICAL SERVICE. *P. Amundsen. Acta Radiologica, April 10, 1924, vol. 3, pp. 1-7.*

The blood picture of radiologists and their personnel always shows a deviation from the normal. The absolute number of white blood cells is often less than the normal average. The change is most marked in the ratio of the polynuclear leukocytes and the lymphocytes: a reduced percentage of leukocytes and an increased percentage of lymphocytes (relative lymphocytosis). The percentage of hemoglobin has nearly always been found normal. The effect on the blood is observed following one or two months of radiological work, and it can also be traced in the maid-servants of the radium department. The blood picture is distinctly improved after a long leave of absence. Improved means of protection are recommended so as to lessen the risk always incurred by all radiological workers. Blood examinations of the personnel belonging to the roentgen and radium institute of the Rikshospital, carried out a long time after the protective arrangements had been revised and improved, showed a considerable improvement of the blood picture of the permanent personnel.

LEAD ORCHITIS. REPORT OF A CASE. *C. P. McCord and D. K. Minster. Jour. Am. Med. Assn., April 5, 1924, vol. 82, p. 1104.*

McCord and Minster report a case of lead orchitis occurring in the foreman of a storage battery "pasting" department, in which a paste of various lead oxides was worked into lead grids. The patient developed a sudden severe pain on the right side of the scrotum the day prior to the examination. When examined, the right testicle was large and tender with no fluid present. The epididymis was swollen and tender in its entirety, and the inflammatory process extended a short distance up the cord. At no time was there pus formation. The patient presented various typical symptoms and signs of lead poisoning in addition to the orchitis and after hospitalization developed lead colic. Under continuous treatment with alkali and potassium iodide, the symptoms disappeared. —K. R. D.

DUST HAZARDS AND THEIR EFFECTS

DUST EXPLOSIONS. *B. Block. Abstr. as follows from Ztschr. Ver. deut. Zuckerind., 1924, vol. 74, pp. 37-64, in Chem. Abstr., May 20, 1924, vol. 18, p. 1573.*

The work of Beyersdorfer and Jaeckel (*Chem. Abstr., 17*, 2192, 2785, 3608) is criticized point for point. They overlooked important factors clearly recognized by others (*cf. Chem. Abstr., 16*, 3395, 3396). Not only static electricity, but mechanical and thermal

causes may start dust explosions. The following recommendations are made. All hard foreign substances must be prevented from entering the mills. All bearings must be outside of the mill housing proper and must be dust proofed and cooled; oil must not be permitted to get into the mills. Mechanical heating of the material to be ground must be prevented by proper construction of machines. The machinery must be kept cool and all dust must be quickly removed by efficient suction apparatus with separate drive. Formation of rust or of sugar carbon must be carefully avoided, or they must be removed at once. Belt slipping must not be permitted. All metal parts must be grounded. Arc lamps are to be excluded and incandescent lamps protected by heavy, dust-proof glass globes. Milling under vacuum might be tried.—P. D.

Dust Explosions. *G. Jaeckel. Abstr. as follows from Ztschr. tech. Physik, 1924, vol. 5, pp. 67-78, in Chem. Abstr., May 20, 1924, vol. 18, p. 1573.*

A theory of dust explosions is given which permits the upper and lower limits of explosions to be calculated from their thermal constants. Satisfactory agreement with the experimentally found values is obtained. The smaller the source of heat from which the ignition starts, the closer the explosion limits, so that the thermal ignition of a dust cloud by sparks appears to be excluded. This is confirmed by experiment. A theory of electrical dust explosions is given, and the density of charge which is necessary for the spontaneous ignition of a spherical uniformly charged dust cloud is calculated. Such a charge has been measured experimentally for sugar dust. The spreading of a dust explosion is promoted by electric ignition. Dust explosions seem to be traceable to the spontaneous ignition of dust particles through friction; afterwards, the electric ignition follows and the resulting flame explodes further masses of dust.—P. D.

New Methods of Dust Determination. *R. N. Kotze. Abstr. as follows from Jour. Chem. Met. Soc. S. Africa, 1923, vol. 24, pp. 1-6, in Chem. Abstr., June 10, 1924, vol. 18, p. 1591.*

An apparatus is described consisting essentially of a brass hand pump attached to a 4-inch glass tube containing a brass impinger and 2 c.c. of water. The pump has a valve attached to regulate the pressure on the incoming air to between 1/3 and 1 atmosphere, giving it a velocity of 200 to 300 meters per second through a nozzle 0.7 mm. in diameter. The jet of air strikes a wet baffle plate 1 mm. distant. The impinged dust is continuously washed from the plate by water entrained in the air stream. The particles suspended in water are counted under a microscope. A detailed sketch of the apparatus is given.

Analysis of Smoke. *H. Salmang. Abstr. as follows from Ztschr. f. angew. Chem., 1924, vol. 37, pp. 97-98, in Chem. Abstr., June 20, 1924, vol. 18, p. 1800.*

A laboratory apparatus is described by means of which the solid particles are precipitated from smoke. An alternating current at 20,450 volts is used and a measured volume of gas containing the smoke is passed through the apparatus in which the particles are electrically precipitated, collected and weighed.—P. D.

Fibrosis of the Lungs Due to the Inhalation of Asbestos Dust. *W. E. Cooke. Brit. Med. Jour., July 26, 1924, p. 147.*

The postmortem findings in the case of a female, aged 33, who had worked since the age of 13 in asbestos factories are described. An X-ray plate showed extensive fibrosis in both lungs, but more marked in the right lung, in which giant cells were numerous around caseous areas and tubercle bacilli were present.—E. L. C.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

Serum Treatment of Anthrax. *E. Bodin. Abstr. as follows from Bull. Soc. franç. de dermat. et syph., Dec., 1923, p. 489, in Brit. Med. Jour., May 10, 1924, p. 846A.*

Bodin describes the treatment of a severe case of anthrax by serum, the patient being

completely cured in a few days. A workman in a tannery, aged 22, had been handling Chinese hides. When seen he had had a swelling on the right side of the lower jaw for three days; it extended from the lobe of the ear to the chin, and from the lower eyelid to the middle of the neck. Over the center of the horizontal ramus there was a typical oval black scar surrounded by the usual vesicles. The patient's general condition was good, his temperature was 100.2° F., and his pulse 100. He received 40 c.c. of serum between November 17 and 20, given in daily doses of 10 c.c. In addition, compresses saturated in 1 in 1,000 mercuric chloride solution were applied locally, and each day 4 or 5 c.c. of 2 per cent. phenol solution were injected at four "cardinal" points of the periphery. Eight days after the commencement of treatment the edema had almost completely disappeared, and one week later the patient was completely cured; the slough had separated, leaving a pink depression 1 cm. in diameter. Bodin quotes statistics which show that the mortality of anthrax is low in those cases treated prior to the fourth day of the disease.

TREATMENT OF ANTHRAX. *O. Grasser. Abstr. as follows from Wien. klin. Wchnschr., March 13, 1924, vol. 37, p. 261, in Jour. Am. Med. Assn., April 19, 1924, vol. 82, p. 1309.*

Grasser had excellent results with neoarsephenamin injections in anthrax. The temperature rose on the day of injection, which had to be repeated, eventually, twice at two day intervals.—K. R. D.

ANCYLOSTOMIASIS IN MINERS. *Belgian Letter, Jour. Am. Med. Assn., April 5, 1924, vol. 82, p. 1135.*

In 1900, a crusade was begun to rid Belgian coal miners of hookworm disease. Dr. Lambinet, collaborator of Professor Malvoz, the prime mover in that crusade, has recently described what has been accomplished. Ankylostomiasis assumed alarming proportions in 1900. An investigation at that time revealed that among 26,000 coal miners in the Liége basin about 25 per cent. were infested, and in some other localities, the percentage was 50 and 60. The results are remarkable. The percentage of miners infected in 1902 was about 26. It dropped gradually to 17, then 12, then 9. At the end of 1906, it was 5 per cent., in 1912 it was 2 per cent., and now it is 0.03 per cent. To secure these results has been an immense task. More than 200,000 microscopic examinations have been made. At the present the dispensaries serve only in a preventive capacity.—K. R. D.

TUBERCULOSIS IN RELATION TO SOCIAL AND ECONOMIC CONDITIONS. *J. S. Purdy. Supplement to Med. Jour. Australia, May 3, 1924, pp. 257-259.*

Evidence is given that mortality from phthisis is lower in New South Wales at all ages than in England. The occupations in New South Wales with a low mortality at all age periods from phthisis are rural workers, engine makers and fitters, miners (coal), railway workers, and carpenters, in the order named. The occupations with a high mortality at all age periods are carters, hotel keepers and brewers, miners (excluding coal), and laborers (undefined), the last named being the highest. In the period 1909 to 1913 the most prolific single cause of mortality among male workers, aged 25 to 65 years, was tuberculosis, which affected printers, boot makers, and painters more than any other tradesmen and rural workers. The evidence is closely in accord with that found in other countries; but the maximum mortality from phthisis is found in New South Wales as a whole and in each occupation specified at the last age group given—namely, 55 to 64.—E. L. C.

BRIEF SURVEY OF THE VARIOUS INQUIRIES INTO PNEUMONOCONIOSIS AND TUBERCULOSIS AMONG AUSTRALIAN MINERS (1902-1921). *F. R. Kerr. Supplement to Med. Jour. Australia, May 3, 1924, pp. 273-275.*

This article is a useful summary of inquiries which have taken place relative to the health of Australian mineral miners. It gives in detail the recommendations of the Technical Commission published in 1922: that (1) the firing of explosives should take place at the end of a shift; (2) a water blast should be used after firing, unless there is a sufficient air current; (3) an interval of thirty minutes should elapse after firing before work is resumed; and (4) special precautions should be employed in boring drill holes.

The incidence of tuberculosis among miners varies almost entirely with local conditions,

and the disease is spread among miners underground because of their intimate contact. Hence all consumptives should be removed from employment in mines. Ventilation is of value to carry away and dilute dust, and to lower temperature; the latter point is desirable for health and efficiency.—E. L. C.

Pulmonary Tuberculosis in Association with Pneumonoconiosis. *S. A. Smith. Supplement to Med. Jour. Australia, May 3, 1924, pp. 275-277.*

A summary is given of the work of the Technical Commission which reported in 1922. Out of 8,966 miners examined, 322 were found showing changes due to dust; of these, 148, or 46 per cent., were suffering from tuberculosis. Out of the remaining 8,644 miners, only 161, or 2 per cent., were found suffering with tuberculosis. Among miners withdrawn from Broken Hill mines on account of silicosis, 132 continued to live in towns or the neighborhoods of cities; of these 36, or 27 per cent., became tuberculous. Among 45 men who went to live away from densely populated areas, only one man, or 2 per cent., became tuberculous.

The evidence favors the view that pulmonary tuberculosis is a new infection among those suffering from silicosis; that is to say, the development is most frequently not an activation of an old lesion. The frequency of infection is proportional to the number of persons with whom the affected worker is daily brought in contact.—E. L. C.

Tuberculosis Survey of the Island of Porto Rico, October 11, 1922, to April 18, 1923. *J. G. Townsend. U. S. Pub. Health Serv., Bull. No. 138, Dec., 1923, pp. 65 and appendix.*

The tuberculosis incidence is comparatively high in towns dependent upon the tobacco industry, due not only to the fact that those sick with the disease seek a trade offering the least physical exertion, but also to the close association in large factory rooms all day, where improper ventilation is frequently found.

In 1916 the cigar makers of Porto Rico organized an antituberculosis association. From 1916 to 1920 the membership of this organization was 3,192; 239, or 7.5 per cent., drew benefits for tuberculosis, representing the terminal cases not able to carry on further. Only 10 of these patients underwent treatment, and in the four-year period 203, or 85 per cent., died. None were restored to health.

The manner of living and the housing facilities of tobacco workers in cities and towns are great handicaps to the successful combating of tuberculosis infection. Tuberculosis is not so prevalent among sugar workers because their work is out of doors throughout the year. Coffee workers do not suffer from tuberculosis to the same degree as tobacco workers, since they are distinctly rural, living in the mountains and not in close association with the masses.—R. M. C.

Memorandum and Tables on the Mortality from Pulmonary Tuberculosis of Men, in London, for the Years 1921 and 1922, in Relation to Age and Occupation. *W. B. Knobel. Tubercle, June, 1924, vol. 5, pp. 409-420.*

Analysis is made of 5,138 deaths from phthisis among adult males in London in 1921 and 1922. The cases are distributed by age and occupation. The "occupied" group with 4,761 deaths exhibits a maximum incidence of the disease at ages 55 to 65, the latest age period considered. In contrast the age of maximum incidence for the rather unsatisfactory group "unoccupied and retired" is as early as ages 20 to 25. The author ascribes the great difference to the occurrence of weaklings and susceptibles among young unoccupied adults and to the effect of arduous work in later years upon the occupied. He arranges the occupations into four groups: one with high phthisis mortality in early and late life; a second with high mortality in early life, but low later; a third with low mortality in early life and high later; and a fourth with low mortality throughout life. The grouping so obtained does not bring together obviously homogeneous occupations. The whole paper is one of considerable interest, and the method of investigation employed might usefully be copied by others.—E. L. C.

The Demonstration by the Fixation Abscess of the Influence of Silica in Determining *B. Tuberculosis* Infections. *E. H. Kettle. Brit. Jour. Exper. Pathol., 1924, vol. 5, pp. 158-164.*

Tubercle bacilli injected into the circula-

tion of rabbits and mice tended to settle in localized subcutaneous lesions produced by various agents which bring increased vascularity and tissue necrosis; the agents used were silica, calcium chloride, turpentine, cholesterin in olive oil, and cantharidin in olive oil. When silica was the provocative agent, the determination of the organisms to the inflammatory focus was invariable, and the bacilli proliferated extensively in such lesions. Inasmuch as similar results were not obtained with other provocative agents, silica appears to have some specific action on the growth of the tubercle bacillus in the tissues. Further experiments are in progress to determine whether silica injures the vitality of the cell or whether it acts as a direct stimulant to the growth of the organism.—E. L. C.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

Dermatology. *Ann. Rep. Chief Inspect. Factories and Workshops for 1923. H. M. Stationery Office, 1924, pp. 63-70. Cmd. 2165.*

This year's blue book contains some items of interest to the industrial dermatologist. Dr. T. M. Legge mentions a factory for making sheep dip (arsenite of soda) where, after many years of work, three employees (out of eight examined) developed cutaneous symptoms—keratosis, pigmentation, and epitheliomatous degeneration. He states that the absorption of arsenic, over a long period, is recognized as being occasionally associated with slowly growing skin cancer. Its experimental production in mice was first described by Dr. A. Leitch.

Of the fourteen cases of anthrax reported in the wool trade, at least nine were due to handling East Indian wool. Six cases of anthrax occurred in just over a fortnight's time in a tannery. The infection was conveyed by a consignment of second quality Hankow hides shipped from New York. Prompt treatment prevented any fatalities.

Chrome ulceration affected fifty-eight persons. Some tanning or dyeing process was responsible for the majority of cases. Four occurred in a paper mill where potassium bichromate and acetate of lead are mixed in water which is almost boiling; this forms chromate of lead (yellow pigment) which is poured into the beaters containing the "half-stuff." The workers become contaminated when feeling with their fingers the condition of the "half-stuff" material. Legge notes three cases of chrome ulceration caused by the recent introduction of chromous fluoride as a mordant in dyeing.

The incidence of mule-spinners' cancer has been specially investigated by Dr. Henry, who collected details of 145 cases of this disease. The cause of the disease has only recently been detected. Of the 145 persons affected, 32.4 per cent. are known to have died of the complaint, and in a few the disease was too far advanced to make operation justifiable; in 93.1 per cent. the serotum was the site of the epithelioma.

The cases of dermatitis reported to the Chief Inspector during the year were as follows:

Dyes and their intermediates	24
Alkalies, caustics, and acids	15
Turpentine	14
Volatile liquids, spirit, polishes, etc.	11
Flour, sugar, etc.	9
Wood dusts	6
Lime and calcium compounds	3
Miscellaneous	13
Non-industrial	5

—R. P. W.

"Maltsters Itch." *M. L. Spillmann. Bull. Soc. franç de dermat. et syph., May, 1924, p. 17.*

In the malt houses of Nancy many examples of maltsters' itch have been seen by the writer. The pruritus is most intense and allows the sufferers neither rest nor sleep. The rash appears as very minute papules, capped by small vesicles. Scratching is followed by a certain amount of exudation, excoriation, and crusting. A prominent feature is that scattered over the affected parts are a number of follicular pustules, each centered by a hair. The trouble, if unrecognized, may last many weeks.

The malting chambers in which the men work are filled with a very fine dust. This is given off in the processes of sifting and heating the barley. The dust, falling on uncovered surfaces of the skin, sets up the irritation. The neck, front of the chest, hands, wrists, and forearms are chiefly affected.

Spillmann was able to remedy the complaint by securing better attention to cleanliness, by covering up the unprotected parts of the skin, and by the application of a simple ointment.—R. P. W.

Eye Affections in Silk Factories. *Dutch Letter, Jour. Am. Med. Assn., March 8, 1924, vol. 82, p. 808.*

The influence of hydrogen sulphide on the etiology of occupational eye diseases having been semiofficially admitted since the articles by Lehmann and others appeared, the government inspectors of factories insist on the introduction of expensive prophylactic measures. Establishments in which artificial silk is manufactured have installed ventilating apparatus to lessen the danger of eye affections. Bakker recently published the results of his research on the manufacture of artificial silk. He describes a superficial keratitis which he was able to suppress by improving ventilation. He does not agree, however, with government inspectors who attribute this affection to hydrogen sulphide. For this to exert a harmful action, he says it would have to be highly concentrated. He showed that in the factory investigated the concentration at the height of the heads of workmen did not exceed 0.09 mg. per liter, and that no other evidence of poisoning by hydrogen sulphide was discovered. The author holds that the symptoms found in workmen resemble the effects of poisonous gases used in the recent war. The best known of these substances are: diethylarsenodichloride and diphenylarsenocyanide. Their action is such that (of the second, for example) one hundred millionth of a milligram per liter is sufficient to produce harmful effects. In factories, liquids are employed that contain chlorine, and arsenic is always present as an impurity in various chemical substances. These interact with organic compounds (cellulose, for example), and it is not impossible that products analogous to those mentioned above are formed. Bakker made three attempts to discover arsenic in the atmosphere but was successful only once. He recommends research on the organic compounds of arsenic, in artificial silk factories and similar establishments, with a view to determining the exact cause of affections of the eyes that occur in such places.—K. R. D.

Steel Imbedded in Eye Six Years without Symptoms. *J. A. Morgan. Am. Jour. Ophth., July, 1924, vol. 7, p. 532.*

"Six years following the accident that caused the steel to pierce the left eye, the patient was awakened in the early morning by a sharp, pricking pain in the same eye. The eye was markedly injected and sensitive to the light. Examination revealed a black foreign body, the size and shape of half a pen point, projecting thru the iris into the left lower quadrant of the anterior chamber. The cornea was slightly opaque in the same quadrant.

"A magnet drew the foreign body into the anterior chamber, from where it was removed by incision and forceps. The eye returned to normal.

"The point of interest in this case is the long balance between the traumatising effect of the steel and the resistance of the tissues involved."

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

Compete for World Records in Kimberly-Clark Plants. *Nat. Safety News, May, 1924, vol. 9, pp. 23-24.*

The Kimberly-Clark Company have three major plants at Kimberly, Niagara Falls, N. Y., and Niagara, Wisconsin. They are engaged in the manufacture of wood pulp. The safety work in these plants has been organized on a competitive basis, and during the past year a contest was arranged and a safety challenge cup was finally won by the Niagara, Wisconsin, plant.

J. I. H.
Oct., 1924

After investigation, the executives of this plant have come to feel that the record they have made—during 1923 there were only five lost time accidents among 653 men—has not been equaled by any other plant in the world.

The executives feel that "right psychology has more to do with accident prevention than guarded machinery. Safety records rather than accident records are featured."—H. B. E.

How Overtime Safety Has Paid Interstate Steel. *C. T. Fish. Nat. Safety News, May, 1924, vol. 9, pp. 15-17.*

The Interstate Iron and Steel Company of Chicago has three plants where safety work has been organized on an efficient plan during the past two or three years. In each of these plants there are shop committees composed chiefly of foremen and in one case of workmen. The safety work is under the immediate direction of Mr. Frank A. Lauerman, safety engineer for the company. This safety work has the backing of the management, and the general superintendent is also very much interested in it.

As a result of the intensive safety work, during 1923 there was a reduction in the frequency of accidents of 15 per cent. over the frequency reported for 1922. "Severity as expressed in compensation costs was reduced 30 per cent. in 1922 over 1921, with a further reduction of 43 per cent. in 1923. Best of all, there was not a single fatality during 1923, although there was a considerable increase in production and much construction work was undertaken."—H. B. E.

Chemical Laboratories. *Safe Practices Pamphlet No. 60, Nat. Safety News, May, 1924, vol. 9, pp. 47-53.*

This paper has many illustrations which graphically tell the story of safety in laboratories. It treats in detail the safety features of:

1. The building, including ventilation, illumination and sanitation, and protection from fire hazards.
2. Housekeeping, stressing cleanliness and order, etc.
3. The storage of chemicals and apparatus.
4. Fire fighting equipment.
5. Gas systems.
6. Compressed gas cylinders.
7. The labeling of bottles.
8. The opening of bottles.
9. Glass tubing connections.
10. Drinking facilities.
11. Desiccators.
12. Filling pipettes and starting siphons.
13. Acid analysis.
14. Nitrometer.
15. Drying samples.
16. Volatile flammable liquids.
17. Disposal of refuse.
18. First aid.

—H. B. E.

How Goggles Should Be Worn. *F. Willson. Nat. Safety News, May, 1924, vol. 9, pp. 31-32.*

The purpose of this article is to consider the complaints of workmen who find the wearing of goggles uncomfortable. The following points are emphasized: first, goggles must conform to the anatomy of the face and should be fitted so as to be comfortable; second, the material of the frame should not irritate the skin; third, the lenses should be flawless, and some provision should be made for correction of refractive errors; fourth, when the goggles steam or are clouded by perspiration, a narrow band of felt should be loosely bound to the forehead just above the eyes; fifth, all measures to correct restriction of side vision should be made.—H. B. E.

General Safety Standards for Workshops and Factories.

Specific Requirements Governing Blowers and Exhausters.

Specific Requirements in Foundries and Core Rooms. Regulations for the Employment of Women in Core Rooms.

Specific Requirements Covering the Operation of Metal Working Machinery.

Specific Requirements for Potteries.

Specific Requirements for Steel Mills.

Specific Requirements Covering the Operation of Wood Working Machinery.

Bulletins of the Industrial Commission of Ohio giving safety requirements effective Jan. 1, 1924.

INDUSTRIAL SURGERY

BACK INJURIES. *A. M. Dickinson. Indust. Doctor, April, 1924, vol. 2, pp. 64-66.*

Back complaints are very frequently met with and are most annoying to the industrial physician or surgeon. This paper was written "with the hope of stimulating more discussion of these cases and thereby making the diagnosis more clear, the estimate of periods of disability more exact, and the institution of correct treatment more early." While many important points are discussed, the most important are the following: the necessity for a thorough history and a complete physical examination, the use of the X-ray, the routine examination of the urine, and the value of the more common laboratory tests such as blood counts and the Wassermann.—H. B. E.

THE RÔLE OF PHYSIOTHERAPY IN LOW BACK CONDITIONS. *F. B. Granger. Indust. Doctor, April, 1924, vol. 2, pp. 67-68.*

The author believes that "success in treatment depends on: first, a careful and correct diagnosis; second, intimate team work between orthopedist and physiotherapist." The greater part of this paper is taken up with treatment in detail of the following conditions:

1. Uncomplicated traumatic cases.
2. Hypertrophic spine aggravated by trauma.
3. Sprain of the lumbosacral or lower lumbar joints.
4. Sacro-iliac strain often associated with sciatica.
5. Myositis.
6. Spinal infections, such as tuberculosis or osteomyelitis.
7. Periostitis.
8. Malingering.

—H. B. E.

SURGICAL ASPECT OF HEADACHE AND PAIN IN HEAD IN RELATION TO ACCIDENT INSURANCE WORK. *E. R. Carpenter. Abstr. as follows from Texas State Jour. Med., April, 1924, vol. 19, p. 681, in Jour. Am. Med. Assn., May 17, 1924, vol. 82, p. 1650.*

Carpenter believes that more than 75 per cent. of the late disabilities from head injuries in industrial work are due to headaches and to pain in the head which arise from injury to the dura mater and meninges, or from bony changes. Often, proper surgical procedures within a reasonable time after the injury will improve or relieve these discomforts.—K. R. D.

FOREIGN BODY IN THE INFRATEMPORAL SPACE. *J. F. Friesen. Jour. Am. Med. Assn., May 24, 1924, vol. 82, p. 1693.*

Friesen reports the removal of several pieces of wood four months after an accident from the infratemporal space of a man employed as foreman on a steam pile-driver. The patient was struck on the side of the face by a large splinter which broke off from a pile. Several pieces of wood were driven through the thin infraorbital plate into the infratemporal space but without injuring the eye. Continued suppuration led to their final discovery.—K. R. D.

HEAT, COLD AND HUMIDITY

NEW GRAVIMETRIC METHOD OF ESTIMATING THE RELATIVE HUMIDITY OF AIR WITH THE HELP OF A FLOW METER. *J. Obermiller and M. Goertz. Abstr. as follows from Ztschr. physik. Chem., 1923, vol. 106, pp. 178-190, in Chem. Abstr., May 10, 1924, vol. 18, p. 1258.*

A method for establishing the relative humidity of air is described which consists in passing a current of air through a meter to determine the velocity and then dividing the stream into two exactly equal parts, one of which is sent through a phosphorous pentoxide drying tube; the other is saturated with moisture and passed through a similar drying tube. Both tubes are weighed, and the fraction, increase of weight of the first drier divided by that of the second drier, gives the relative humidity.—P. D.

WOMEN AND CHILDREN IN INDUSTRY

THE HOME SWEATSHOP AND ITS HEALTH PROBLEMS. *C. V. Craster. Nation's Health, May, 1924, vol. 6, pp. 306-308, 361.*

The author reviews the factors which give rise to the home sweatshop and discusses the insanitary conditions under which work is performed. While the need of legislation in this field has been recognized and carried out in certain states and some foreign countries, there is usually not an effective enforcement.

Recent investigations in New Jersey show that there is almost a total disregard of the laws regulating home work. "Sixty-five per cent. of the homes visited were below the standard of general health and sanitation and found to be very dirty, 30 per cent. were found to be fair, and only 3 per cent. measure up to the minimum standard of general cleanliness. Ninety-five per cent. of all home work was being done in the kitchen. From 35 to 40 per cent. of the work is done by children under fourteen years of age."

Such conditions are the result of a lack of efficient machinery to enforce the law. It is suggested that co-operation between the state and local health boards and the state department of labor might result in better enforcement. A minimum wage schedule is also suggested. The Australian method of curbing the sweatshop system is reviewed and is shown to be the most advanced, since it removes a number of trades from the home to the factory.—G. B. R.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

HEALTH OF INDUSTRIAL WORKERS. *G. E. Tucker. Nation's Health, April, 1924, vol. 6, pp. 234-235.*

Since two-thirds of the worker's time is spent outside of the plant, personal hygiene undoubtedly plays an important part in disease prevention and health maintenance. The author recommends education of the worker in such matters as the proper selection and preparation of wholesome food, the amount of exercise and recreation that is beneficial, the desirability of utilizing any medical facilities furnished by the employer, home sanitation, and safety measures.—G. B. R.

PERSONALITY A GREAT ASSET TO THE INDUSTRIAL PHYSICIAN. *H. S. Murat. Nation's Health, March, 1924, vol. 6, pp. 162-164.*

Attention is called to the necessity of gaining the sympathetic interest and confidence of the employees of a plant. The methods employed by the author are (1) friendly contact with the men, and (2) publication of timely discussions of health questions in the plant publication.

The latter part of the article describes the medical department at the Armco works.—G. B. R.

MEDICAL DEPARTMENT OF THE ALABAMA POWER COMPANY. *Nation's Health, May, 1924, vol. 6, pp. 340-341.*

This article is a description of the way in which one company, whose activities extend over a large territory, solves the problem of giving medical care to its employees. At the present time the staff consists of ninety-seven surgeons scattered over the state but under the supervision of a chief surgeon. Plant hospitals are erected in localities in which large construction jobs are in progress, and strict sanitary conditions are enforced. Each man employed by the company is required to have a physical examination. Recreational facilities and social affairs are provided, and the company maintains a vacation camp.—G. B. R.

HOSPITAL DATA FROM THE TRUMBULL ELECTRIC MANUFACTURING COMPANY. *Nation's Health, April, 1924, vol. 6, pp. 270-271.*

This company employs about 465 persons, chiefly Americans, with a few Italians. During the year 1922, 6,157 visits were made to the company's hospital, of which 1,538 were consultations with the physician and 4,619 visits to the dispensary. These visits were

made by 980 men and 190 women and represented 120 days of lost time for which compensation was paid. The non-compensated lost time was 351 hours.

All machinery is safeguarded and only four minor amputations have been necessary in four years.—G. B. R.

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

Well Co-ordinated Welfare Work at Hygrade Lamp Company. *Nation's Health, March, 1924, vol. 6, pp. 165-166.*

This is an exposition of the methods which are believed to have brought the yearly turnover of the company down to a 17 per cent. basis. Low cost meals are served in the cafeteria, and music is furnished for dancing during the noon hour. Pay during vacations is determined by length of service. A hospital with a nurse is maintained, as well as careful supervision of the comfort of the employees during working hours.—G. B. R.

Employee Service of Marshall Field's. *Hosp. Management, March, 1924, vol. 17, pp. 66-68.*

Besides the medical department, Marshall Field and Company includes in its employee service sales training, a school for junior clerks, a large library, a choral society, a lunch room which serves 6,000 employees daily, and numerous other activities. In the medical unit there are one full-time surgeon, four part-time physicians, and four trained nurses. The physician in charge spends four hours a day in the medical department and the remainder of his time in private practice and teaching. It is the policy of the medical department to do as little as possible of the work which is generally handled by the private practitioner.

The Marshall Field employees receive half pay during illness. Free beds are provided at three hospitals, and a large sanatorium is supported by the company in common with other department stores.—H. B. E.

MALINGERING

Traumatic Neurasthenia. *E. F. Buzzard. Ment. Hyg., April, 1924, vol. 8, pp. 425-437.*

This paper is an exceedingly illuminating exposition of the psychological causes of protracted convalescence following injuries where compensation is an important factor. The experience of the author allowed him to formulate two definite conclusions about traumatic neurasthenia: First, that the clinical picture is identical with that of anxiety neurosis; and, second, that the incidence of neurasthenia on trauma is quite independent of the site or the severity of the latter, but is dependent upon inherited nervous instability to a small degree. The most important factor, however, in all cases is responsibility. The attitude of the attending physician is another factor which makes for the development of the neurosis; through his unwitting aid and that of a sympathetic wife and neighbors, a state of anxiety may be developed. Behind all this is the injured person's knowledge that his employer was responsible for his injury and is still responsible for his getting well. At any rate, a chronic invalidism ensues which the knowledge of the mental mechanisms involved could have prevented.

The hypersuggestibility of the patients is touched upon and the mental mechanisms in some of the typical cases are described with some detail.—H. B. E.

The Detection of Malingering in Industrial Ophthalmology. *S. Walker. Nation's Health, April, 1924, vol. 6, pp. 243-244.*

Under the head of malingering in industrial ophthalmology are: (1) simulation of an ocular injury or disease which does not exist; (2) false attribution, the assignment to an actually existent disease or injury of

an untrue cause; and (3) exaggeration, the pretense that a certain injury or disease, which does actually exist, is greater than is really the case. Closely related is dissimulation, the pretense that an actually existent disease or injury does not exist.

The most commonly feigned diseases of the eye are amblyopia, amaurosis, kopiopia, and scotomata and contraction of the fields. The author gives tests for detecting the malingering of these various conditions and discusses briefly the detection of the other types of malingering met with in industrial ophthalmology.—K. R. D.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

Analysis of Mexican State Laws on Wages and Hours of Labor, and Employment of Women and Children. *J. Ritchie, 3d. U. S. Month. Labor Rev., Nov., 1923, vol. 17, pp. 1179-1191.*

Protection of Workers under Mexican State Labor Laws. *E. C. Yohe. Ibid., Dec., 1923, pp. 1237-1249.*

Comparison of Workmen's Compensation Laws of the Mexican States. *E. C. Yohe. Ibid., Feb., 1924, vol. 18, pp. 217-226.*

These three articles review the federal and state laws based on the new federal constitution which superseded the old constitution of 1857. Article 123 of the new constitution contains many provisions on labor and social welfare to guide the federal government and the governments of the various states not legislating on these matters. The provisions regulating hours of employment and rest periods are as follows: Eight hours shall be the maximum limit of a day's work; seven hours shall be the maximum limit of night work; every workman shall be given at least one day's rest for every six days' work; overtime work shall not exceed three hours per day nor take place on more than three consecutive days; contracts providing for an excessively long working-day shall be held null and void.

This same article prohibits the employment of women and young persons under 16 years of age in dangerous and unhealthful occupations. It requires employers in agricultural, industrial, mining, or similar classes of work to furnish comfortable and sanitary dwellings for their workmen, the annual rent charged for them not to exceed 6 per cent. of the assessed value of the property. Employers are also required to provide schools, dispensaries, markets, and other services necessary to the community. The adoption in factories and shops of sanitary conditions and safety devices is compulsory. The article provides that a worker may quit his employment at the expiration of the contract without being held liable for breach of contract if the employer or his subordinate with his consent maltreats the worker or his family. In such a case, the employer shall either perform the contract or pay the worker an indemnity equal to three months' wages. The laws of the Mexican states are based more or less on these constitutional provisions.

The federal constitution of Mexico, section 4 of article 123, forms the basis of the workmen's compensation laws of the Mexican states. This section is as follows: Employers shall be liable for industrial accidents and occupational diseases arising from work; therefore, employers shall pay the proper indemnity, according to whether death or merely temporary or permanent disability has ensued, in accordance with the provisions of law. This liability shall remain in force even though the employer contract for the work through an agent.—H. B. E.

Lead Processes: Western Australia. *Internat. Labour Office, Indust. and Labour Information, May 5, 1924, vol. 10, p. 165.*

An amendment in 1923 to the Factories and Shops Act of 1920 requires the provision of suitable washing and messroom accommodation and the notification of all cases of lead poisoning. The Governor is empowered to issue further regulations to protect workers in lead processes.

Standards for Workmen's Compensation Laws Revised to January 1, 1924. *Am. Assn. for Labor Legis., Leaflet No. 14, pp. 12.*

REHABILITATION OF DISABLED EMPLOYEES

Relationship of Occupational Therapy to Rehabilitation. *F. G. Elton. Arch. Occupational Therapy, April, 1924, vol. 3, pp. 101-108.*

By "rehabilitation" is meant the restoring of disabled human beings to former rank and position "in so far as it physically, mentally and vocationally is possible." No particular service is meant but the "whole group of services that tend to restore him (the injured person) as an independent worker in so far as it is possible." In this sense occupational therapy is an important part of rehabilitation.

The author is optimistic and feels that "the time has come when everyone concerned in any service that affects the rehabilitation of an individual will recognize that their service is but one link in the chain and that by playing their part they will make the task of each of the others easier and more readily accomplished for the greatest good of the injured person."

The author stresses the therapeutic value of occupational therapy in that it not only makes for a medical cure but means "vocational re-establishment" which means a permanent and more satisfying adaptation.—H. B. E.

INDUSTRIAL MORTALITY AND MORBIDITY STATISTICS

Morbidity Figures of Various Public Service Occupations. *F. R. Kerr. Supplement to Med. Jour. Australia, May 10, 1924, vol. 1, pp. 306-308.*

Examination of morbidity statistics discloses that:

The Victorian State School teacher as a whole shows a slightly higher sickness experience than we would expect (7.62 days in a year of 219 days).

The male teachers (5.00) are below the average, though slightly in excess of the London male teacher, while the females (9.09) compared with American office workers, Victorian female postal employees, and English female teachers show a slightly excessive sickness rate.

The taxation and postal officers (10.6) are greatly in excess as regards sickness, in comparison with other similar occupations.

The figures of the Victorian Railways (6.16 days per man) are toward the low side, considering the hazardous calling of many of the employees.

A loss of six days out of a working year is equivalent to the incapacity of 2 per cent. of the total industrial population of Australia—*i.e.*, the labor of 30,000 people is lost in the Commonwealth every year on account of sickness.

Similarly, the figures of the friendly societies show that the 493,978 members lose 6.6 days a year and this is equivalent to the loss of the labor of about 10,000 of their adherents annually through illness.—E. L. C.

ABSTRACT OF THE LITERATURE
OF
INDUSTRIAL HYGIENE

VOLUME VI NOVEMBER, 1924 NUMBER 7

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GENERAL

FACTORY INSPECTION: AN ITALIAN VIEW. *Internat. Labour Office, Indust. and Labour Information, April 7, 1924, vol. 10, pp. 7-8.*

"Factory legislation has undergone two severe crises since the war; the first as a result of demobilisation, and the second on account of the preponderance of capitalist interests in certain countries."

International competition has been an obstacle to factory legislation, but the establishment of the International Labour Office will remedy that by developing international social legislation.

The International Labour Conference adopted a series of decisions on the subject of factory inspection: It should be concerned not only with the liberty of the workers, but also with the development of industry; employers must look upon the inspectors as colleagues, not enemies; inspectors must refrain from disclosing manufacturing secrets and industrial processes with which they may become acquainted in the exercise of their functions.

The object of all social legislation is national self-preservation and this can only be secured in practice by means of factory inspection.—R. M. C.

FACTORY INSPECTION IN GREECE IN 1921. *Internat. Labour Rev., July, 1924, vol. 10, pp. 136-143.*

The interest of this report is the lurid light it casts on industrial conditions in Greece. Something, however, is gained by illuminating dark corners; the need for cleaning is made apparent. Prohibition of employment under 14 years of age is a dead letter; even restriction to six hours for children between 12 and 14 is not carried out, and street trading

by children is frequent; in the Piraeus 70 per cent. of women workers had no education. Hours of work are as a rule ten a day. Night work at spinning and weaving goes on with collusion of the women workers. Health and safety conditions are regrettably bad; there is water shortage in Athens and an entire disregard for cleanliness; in general there is no drainage and legal regulations on conveniences are useless.

In bakeries no special sleeping accommodation is provided and the staff spends the night on the floor, on empty sacks, and under the counter; in the country, poultry, goats, sheep, old bedding, clothes, and shoes are to be found in the shops. In confectioneries, workrooms behind shops in Athens lack ventilation, light, cleanliness and order; sugar, flour, and dust are sticking even to the machinery. Accidents are frequent and tuberculosis prevails among shoemakers, printers, woodworkers, and tailors; in Athens tuberculosis accounted for 39 per cent. of all deaths. Housing conditions in Syra (Aegean Islands) are satisfactory "because the nature of the land is such that underground dwellings are impossible." Such today is the country where Aesculapius was worshiped, Hygeia venerated, and Hippocrates appreciated.—E. L. C.

Factory Inspection in the Czechoslovak Republic in 1922. *Internat. Labour Rev., July, 1924, vol. 10, pp. 143-148.*

The report records work done in an up-to-date industrial community. The eight-hour day is generally accepted and night work is exceptional, but the bakery industry owing to tradition and competition is proving difficult to bring into line. The law as to employment of women and children is well enforced and their exclusion from unsuitable and dangerous work is insisted upon. Prices have decreased and food has become abundant; hence health of workers has materially improved and undernourishment is rare. Works councils have been started, but have not yet fully developed owing to trade depression. In this country the inspectorial staff plays an important part in trade disputes. The success of strikes has been proportional to trade success.—E. L. C.

Industrial Inspection in Belgium in 1922. *Internat. Labour Rev., July, 1924, vol. 10, pp. 148-151.*

The main work reported is enforcement of the eight-hour day act. The hourly output of the individual worker was found greater during an eight-hour day than during a ten-hour day, though usually not sufficient to make up entirely for the two hours' reduction. In some cases a system of two eight-hour shifts has been adopted and even of three-hour shifts during the busy season in the sugar industry. Here agricultural workers were attracted to fill the factory demand for labor, causing a serious shortage in the beet fields which supplied those same factories. Prohibition of night work in bakeries has caused trouble and resistance which are being overcome. In other respects steady progress is recorded.—E. L. C.

Factory Inspection in India in 1922. *Internat. Labour Rev., July, 1924, vol. 10, pp. 151-153.*

Industrial development in India moves slowly, fortunately so, as it is enabling legislation and inspection to keep pace. The law calls for modification where physical development is more rapid than in temperate climes; the minimum age for employment of children for six hours only is 9 years; adult life commences at 14 years. The new Act introduced a sixty-hour week and a daily maximum of eleven hours for adults; but the average weekly hours are nearer fifty-four in two-thirds of the factories and forty-eight or less in one-third. Night work for women is prohibited. Attention is being directed to improving sanitation, ventilation, and dust prevention. On the whole India is behindhand, but is escaping some of the worst accompaniments of introducing the factory system; in Madras good welfare work is reported from a number of large mills.—E. L. C.

Industrial Conditions in China. *Indust. and Labour Information, Internat. Labour Office, March 24, 1924, vol. 9, pp. 396-398.*

A recent estimate in China puts the number of modern factories at about 1,800 (not including thousands of semi-modern ones); among these may be mentioned 109 cotton spinning and weaving mills, 218 silk filatures, 95 flour mills, 82 electric lighting plants, 121 oil mills and bean cake factories, 43 albumin factories, 51 cement and brick works, 58 printing presses, 54 soap and candle factories, and 51 telephone companies.

J. I. H.

It is estimated that over 70 per cent. of the working people work seven days in a week. Work is suspended from three days to two weeks at the Chinese New Year, and there are two general holidays.

Modern machinery has reduced the skill needed for operation, so that women and children may be employed to attend to mechanical processes. They are generally willing to work for lower wages than men. Taking all branches of industry together, probably 15 per cent. of the employees are women, 20 per cent. boys and girls under 14, and 65 per cent. men.

State regulation of labor was first attempted in March, 1923, when the Board of Agriculture and Commerce published twenty-eight articles governing the conditions of employment. Among the main features may be mentioned the prohibition of child labor for boys under 10, and for girls under 12; the institution of less strenuous working conditions for junior workers (boys from 10 to 17 years of age, and girls from 12 to 18); and the decision that the working-day should not exceed eight hours for the junior workers nor ten for adults. Employers are made responsible for giving elementary education and free medical care to their employees; factory inspection by local inspectors is also instituted.—H. B. E.

Sickness and Accident in Relation to Employment. *J. S. Purdy. Supplement to Med. Jour. Australia, May 17, 1924, pp. 314-315.*

Figures are given by Dr. Purdy of sickness and accidents among employees of the Sydney Municipal Council while working (*a*) a forty-eight-hour week, (*b*) a forty-four-hour week with no Saturday work, and (*c*) a forty-eight-hour week again. The second as compared with the first resulted in a drop of 43.8 per cent. in absenteeism from sickness and of 12.7 per cent. in absenteeism from accident. When the longer week was reverted to, both the sickness and accident rates rose and nearly equalled those previously experienced. The actual time lost for sickness was considerably below the English average and that for accidents only half; the ratio of lost time for sickness to that for accidents was a little more than double.

The author stresses the points that a day's work should stop short of undue fatigue, and that overtime means overwork.—E. L. C.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

Lead Poisoning among Pottery Workers. *F. Shufflebotham. Abstract of Paper Read at Conference of People's League of Health at Wembley, May, 1924.*

There are between 60,000 and 70,000 men, women and girls engaged in the pottery industry in Great Britain; in the North Staffordshire district, which is one of the most important pottery centers of the world, there are nearly 5,000 employees engaged in processes which expose them to lead poisoning. In this district it is estimated that there are 2,600 people working in lead processes, 1,300 in work employing a low solubility glaze, and 800 in what is assumed to be leadless glaze. The nature of the employment is as follows:

Leadhouse men	100
Dippers and ware cleaners	1,650
Glost placers	1,900
Glost oddmen	450
Majolica painters (female)	150
Groundlayers	150
Aerographers	300

Leadless glaze factories are mainly those that make electric fittings, stilts and spurs, Longton china, and sanitary fire clay ware.

The various investigations that have been made have prompted the Home Office to make regulations which have practically wiped out acute cases of lead poisoning, but postmortem examinations made on lead workers have shown conclusively that life has been shortened and death accelerated as a result of employment in lead processes even under such conditions as the Home Office has imposed.

These examinations have revealed a great deal of information on the action of lead and lead salts upon the human system. The prin-

cipal conditions disclosed by these examinations have been:

1. Hypertrophy of the heart, with atheroma of the aorta and the aortic valves.
2. Granular and contracted kidneys, with very little cortex.
3. In some instances cerebral hemorrhage.
4. Rarely, constriction of the large intestine.
5. Occasionally, blue line round the anus. (In the last ten years three cases have been seen.)

In view of the fact that there are practically no cases of acute lead poisoning, those of chronic lead poisoning require very careful investigation. The symptoms of chronic lead poisoning during life are those of general arteriosclerosis. One finds hypertrophy of the heart and a high blood pressure; the urine invariably shows a low specific gravity. With regard to albuminuria and casts, these points are not an invariable factor, but with the low specific gravity and frequent micturition, especially during the night, one can form a pretty safe conclusion as to the condition of the kidneys. Among the cases of lead poisoning under care at the North Staffordshire Infirmary, the urine for each day is collected and samples are examined; even then, when there is no doubt that the patient is suffering from lead poisoning, some days elapse before albumin is found in the urine.

The blood pressure may mount to extraordinary heights, and in one instance recently, a patient in the North Staffordshire Infirmary who had been in bed for two weeks had a blood pressure which rose to what is equivalent to 260 mm. Hg; strange to say, he recovered.

Anemia is a well-known concomitant of lead poisoning, and the examination of the blood shows a diminished percentage of hemoglobin, and in many instances basophilic granulation of the red blood corpuscles.

The subjective symptoms of this complaint are headache, constipation, vomiting, abdominal colic, pain in the arms and legs, shortness of breath, and giddiness. In some cases there is wrist drop, but this is not so frequent as it was twenty years ago.

In view of the fact that acute cases of lead poisoning are now practically non-existent, one does not have to deal with eye troubles, except as a complication of general arteriosclerosis.

Although many manufacturers have been for some time and are now using low solubility glazes, thereby reducing the risk of lead poisoning among their operatives, low solubility glaze is by no means free from danger and may cause lead poisoning in a marked degree, even though the operative may never have worked in an ordinary lead glaze. One case in particular that came under notice recently is that of a young woman who has never worked in an ordinary lead glaze, but who worked for about four or five years in a low solubility glaze. She is undoubtedly suffering from lead poisoning, and in fact is now receiving full compensation for it. The dust arising from a low solubility glaze is composed of much finer particles than the ordinary lead glaze, and therefore the worker is much more liable to inhale it.—H. P.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

Investigation of Twenty-Four Cases of Human Anthrax Occurring in New York City from October, 1920, to December, 1923. *W. Jacobsohn. N. Y. City Dept. Health, Month. Bull., March, 1924, vol. 14, pp. 49-66.*

This is an excellent series of cases of clinical anthrax investigated by the author as part of his routine work as industrial medical inspector.

In most of the cases the infection was traced to infected material. Contact with hair, hides, and skins was the usual mode of infection. Eight of the patients died. The cases which were diagnosed early and were given immediate anti-anthrax serum treatment showed the more fortunate prognosis. One woman pregnant six months died, however, in spite of active serotherapy. Local treatment of the pustule plus the use of anti-anthrax serum both locally and intravenously was the usual routine treatment. Forty cubic centimeters of serum administered intravenously every four hours was the dose employed.—H. B. E.

THREE CASES OF HUMAN ANTHRAX. *N. Y. City Dept. Health, Week. Bull., May 17, 1924, N. S., vol. 13, pp. 146-148.*

Three cases of human anthrax are described in this article. The first is that of a young man employed by a manufacturer of brushes and celluloid articles. In handling clothes brushes, tooth and shaving brushes, he received an infection of the skin of his face—a pimple which developed into a vesicle the next day. The condition was diagnosed as anthrax about one week later, smears and cultures being positive. Anti-anthrax serum was administered for four days and the patient was discharged as recovered one week after treatment was commenced.

The second case is that of a woman, 51 years of age, employed in a hair brush factory. Illness commenced with symptoms of coryza. On the fourth day of illness she was seen by a physician who ordered her immediately to a hospital. The diagnosis on admission was Ludwig's angina. A culture from the throat gave large spore-bearing bacilli. On the sixth day of illness the patient died, a tracheotomy having been performed three hours previously. Autopsy findings (septicemia and involvement of the tissues of the left side of the neck) confirmed the diagnosis of anthrax. The most marked symptom was the serious interference with breathing.

The third case is that of a longshoreman, aged 51 years, who handled animal skins. One of the wires which held the bundles of skins together scratched his neck. During the next three days the neck began to swell. On the fourth day the man quit work. His chief complaints on entering the hospital were the open sore on the side of his neck, pains in the chest, shoulders, and back, headache, chills, fever, temperature 102.6, pulse 100, and general malaise. On the day of admission a blood culture was taken with negative result; direct smears were found positive for anthrax. Local and intravenous injections of anti-anthrax serum were administered. The patient was definitely on the road to recovery on the fourth day of treatment and was discharged on the ninth day after admission.—H. B. E.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

REDUCING ACCIDENT RISKS. *Factory, April, 1924, vol. 32, pp. 499-500, 544, 546, and 548.*

In this article representatives of thirteen concerns describe measures taken to reduce common accident hazards in their respective industries.

PREVENTION OF ACCIDENTS BY EDUCATIONAL METHODS. *A. Williams. Abstract of address delivered before Metropolitan Section of National Electric Light Association in New York, May 2, 1924.*

It is possible to prevent only 25 to 50 per cent. of industrial accidents through mechanical means; for the prevention of the rest we must turn to educational methods, better supervision, and improved morale of employees. But before we can hope to secure the co-operation of employees in any educational activity, we must make the place of work safe from the physical and mechanical points of view.

The New York Edison Company, in the training of its employees, gives special attention to the question of accident prevention. Every employee knows that a prerequisite to promotion to any job is a thorough knowledge of the safety rules and practices of that job as well as of his own. A great deal of the safety education of the employees is brought about through talks to the men in groups and as individuals, since it is believed that carelessness is as much a frame of mind as a bodily habit.

NEW YORK'S SAFETY MUSEUM. *A. A. Hopkins. Safety Engin., April, 1924, vol. 47, pp. 165-167.*

The American Museum of Safety, established in 1907 and incorporated in 1911, opened its new quarters in New York City in co-operation with the New York State Department of Labor.

The Museum consists of two parts. In the first are shown resuscitation devices, first-aid kits, protective clothing, goggles, masks of all kinds, fire extinguishers, photographs, charts, etc., and the exhibit of the U. S. Steel Corporation as shown at Rio de Janeiro. In the machine room are found various pieces of

machinery such as lathes, grinding wheels, saws, etc., equipped with safety guards, sewing machine tables, laundry presses, a compressed air paint spray booth, and a 12-foot elevator, equipped with four types of safety doors.—B. A.

THE DUTCH SAFETY MUSEUM. *R. A. Gorter. Safety Engin., April, 1924, vol. 47, pp. 185-186.*

The Dutch Safety Museum has its own building but is still a private foundation subsidized by the Dutch Government and the municipality of Amsterdam. The Museum was first established in Amsterdam in 1893.

The present building contains a machine hall in which all the machinery is safeguarded; and as every machine can be driven by motor, every safeguard can be tested by interested visitors. Safeguards in the chemical industry, the protection against fire and explosion, and the safeguards of scaffolds, tools, stairs, ladders, and floor openings are also exhibited. There is an electrical division, and a hygienic and health division.—B. A.

NURSES AND ACCIDENT PREVENTION. *S. M. Miller. Hosp. Management, April, 1924, vol. 17, pp. 66-68.*

The square deal has proved to be a paying proposition in the health and accident work of the Holt Manufacturing Company. The goodwill of the employees has been gained through understanding and sympathy and a genuine regard for their personal problems. In the settlement of compensation claims, it is rare for a serious controversy to arise; the greater number of claims are settled without recourse to the compensation board.

Accident prevention is an important item in the work of the Company physician and nurse; through earnest appeals to the interest of the workers, the number of accidents has been cut down.

The study of accident records is shown to be valuable. In particular, these records have been used in the study of two groups of injuries—eye injuries and open wounds; the data obtained have been employed in a publicity campaign. In the case of employees having an unduly large number of accidents, the individual records are closely scrutinized. Home conditions, financial factors, and the human element are stressed as important factors in the causation of industrial accidents.

In studying accidents, the company classifies them according to their distribution in the factory, according to occupations, and according to lost time involved. It also groups them according to fundamental causes as follows: (*a*) accidents due to the inherent hazard of the plant and industry; (*b*) preventable accidents for which the management is responsible; and (*c*) preventable accidents for which the employee is responsible.

The author believes that the industrial nurse should have a fundamental training in nursing in a general hospital and that she should be a person possessing tact, poise, sympathy, and understanding.—H. B. E.

FATAL INDUSTRIAL ACCIDENTS IN CANADA. *Internat. Labour Office, Indust. and Labour Information, May 26, 1924, vol. 10, p. 298.*

In 1923 there were 1,396 fatalities in Canada as a result of industrial accidents, as compared with 1,128 in 1922. There were 367 deaths (26.2 per cent. of the total) in the transportation and public utilities group of industries. Other groups were as follows: manufacturing, 14 per cent. of the total; mining, 13.5 per cent.; lumbering, 13.8 per cent.; and agriculture, 9.2 per cent.—R. M. C.

ACCIDENTS AT METALLURGICAL WORKS IN THE UNITED STATES IN 1922. *U. S. Month. Labor Rev., April, 1924, vol. 18, pp. 842-843.*

The statistics of accidents at metallurgical works compiled by the United States Bureau of Mines represent the entire metallurgical industry of the United States with the exception of iron blast-furnace plants.

Figures for the number of men employed, average working time per man, and amount of labor performed by all employees show substantial increases over the preceding year. The fatality rate was 0.98 per thousand 300-day workers, and the non-fatal injury rate was 145.15. The corresponding rates for the preceding year were 0.76 and 126.74. There was a total of 6,723 accidents, 0.67 per cent. of which were fatal.

Two tables are given, the one showing the number of accidents in metallurgical works for the period 1916 to 1922 classified according to severity; the other, fatalities and injuries per million hours' exposure for the

year 1922 classified according to length of shift.—P. K. C.

SAFE PRACTICES IN ACETYLENE AND OXYGEN WELDING. *H. S. Smith. Safety Engin., April, 1924, vol. 47, pp. 208-213.*

Safe Practices Pamphlet No. 23 of the National Safety Council is highly recommended for use in plants employing oxyacetylene welding. Equipment approved by the Underwriters' Laboratories of Chicago and gases manufactured according to the specifications of the Interstate Commerce Commission are urged for initial safeguarding. In the storage of supplies and the installation of equipment the rules of the National Board of Fire Underwriters covering installation and operation of acetylene equipment, as well as the instructions supplied by the manufacturers of the acetylene generator or other equipment, should be followed.

Other rules for safe practice may be summarized as follows: Store supplies of calcium carbide and cylinders of compressed acetylene only in dry, well-ventilated places; oxygen should never be stored in the same compartment with acetylene; great care should be taken in handling the gas cylinders.

Recommendations are also made as to safe practices in the installation of pipings, in the operation and care of generators, and as to safety goggles, gloves, and fireproof clothing for operators.—B. A.

SAFEGUARDING OIL WORKERS. *R. S. Bonsib. Safety Engin., May, 1924, vol. 47, pp. 217-222.*

Accident prevention in the oil industry is no longer regarded as welfare work but is now considered an important production factor. In the case of the Standard Oil Company (New Jersey) the three years of active accident prevention work ending December 31, 1923, resulted in a reduction of 50 per cent. in the frequency rate of lost-time accidents and a reduction of 52 per cent. in the cost of accidents. Experience has shown that safety work can be justified on a strictly monetary basis.

An analysis of accidents in the oil producing field, with a similar result in the refineries, showed that the major portion of accidents was the result of failure on the part of the human factor. Educational efforts are, therefore, very important, to the end of cultivation of the safety instinct, of thought in terms of safety, thus reducing the willingness of workers to "take a chance." With this idea, illustrated lectures in connection with a local talent entertainment—to avoid too much of the lecture room atmosphere—have been given, to which the men's families are invited, not only so that their presence may the more impress the worker with his responsibilities, but also that the safety habit may extend to the home.

Constant watch is maintained for accident hazards through a system of zone inspection; the refineries are divided into zones of such a size that they can easily be covered in about half an hour. Three members of the safety committee are assigned to the inspection of and are held directly responsible for conditions existing in each zone; assignments are made according to a schedule so worked out that each member is assigned to a different zone.

In the marketing department other educational means employed are special letters, which bring a personal touch, written by the division managers at frequent intervals to injured employees. New employees are given safety instructions as a regular part of the employment procedure.—B. A.

SAFETY ENGINEERING IN A MODEL FOOD PLANT. *J. M. Thorsen. Safety Engin., May, 1924, vol. 47, pp. 243-245.*

The Beech-Nut Packing Company of Canajoharie, N. Y., employs an inspector familiar with industrial safety standards and versed in ventilating, lighting, fire prevention and sanitary methods, to make daily inspection of the plant, give written recommendations for necessary standard safeguards or safety precautions, arrangement for materials, cleanliness, lighting and ventilation, and to look after fire-fighting apparatus and exits and report fire hazards if any are found. Once a month a committee of three workmen from the plant makes an inspection; its report is submitted to the plant inspector who refers it to a general committee of the vice president, engineer, and superintendent. Twice a year safety moving pictures are shown at a meeting of the employees; bulletin boards are placed in conspicuous places bearing timely warnings.

All hazardous machine parts, etc., are

guarded according to the most approved safety standards. There is a well-equipped emergency hospital at the plant, with a graduate nurse in attendance and a licensed doctor available at all working hours; also a large recreation hall and lunch room. The health and comfort of employees are well provided for; the cleanliness of employees is made easy through supplying fresh towels and uniforms and even a manicurist; the floors, walls, and equipment of the plant are especially made or finished so that they may be easily kept clean, with day cleaners and night cleaners always on duty.—B. A.

INDUSTRIAL SURGERY

Orthopedic Principles in Industrial Surgery. *J. E. Bacon. Southwestern Med., April, 1924, vol. 8, pp. 176-179.*

In this communication, Dr. Bacon gives some of the lessons learned in an experience of twenty-five years of industrial surgery. He acknowledges the debt owed the orthopedic surgeons for their contributions—especially those which deal with prevention of loss of function and with restoration of function.

Instead of using the orthodox method of treating a fractured femur by extension and immobilization for six to eight weeks, the Thomas splint or one of its modifications is now employed. In fractures of the leg, the use of the Stienman pin for extension and the cutting of the Achilles tendon to keep the foot in flexion have decreased the time usually lost from two to four months.

In Pott's fractures, dorsiflexion of the foot with the required degree of inversion and active movement of the ankle three weeks after injury are enthusiastically recommended. Directions for correct padding are also given.

Sequelae of fractures, such as paralyses, are well taken care of if treated according to orthopedic principles. For instance, where there is a tendency toward extension, immobilizing the member in semi-flexion considerably cuts down the period of recovery. The principles which apply in treating fractures of the upper extremity apply in treating fractures of the lower extremity.

In the treatment of burns, the use of paraffin with proper splinting is heartily recommended.

"Injuries about the wrist and hand have a more serious aspect to the wage earner than those of any part of the body, even to loss of a leg, and cause more lost time by far than all others combined, first because they are so frequent, second because they are usually considered minor injuries and do not receive the attention they deserve, third they are difficult to treat because the patients are ambulant and dressings are constantly interfered with." The invariable use of an anesthetic with fluoroscopic control is advised in the reduction of Colles' fractures.

The well-known and important orthopedic principle of posturing a part so that if the worst occurs it will be in the most useful position is stressed.—H. B. E.

Possibility of Remote Effects in Head Injuries—A Case Report. *C. E. Mordoff. Cal. State Jour. Med., Feb., 1924, vol. 22, pp. 59-61.*

The author cites the following case as indicating the possibilities in industrial surgery.

The patient, a blacksmith, 48 years of age, was injured across the bridge of the nose by a heavy piece of steel and suffered severe headache in the frontal and temporal regions thereafter for about three months. At this juncture, he was treated for chorioretinitis and chronic suppuration of the right ear and was discharged greatly improved, though still complaining of the headache and having impairment of touch, pain, and temperature in the right supra-orbital and infra-orbital nerves. Nearly a year after the accident a radical mastoid operation was performed, and two weeks later a thrombosed lateral sinus was removed. The patient recovered, but he still complains of headache.

The general physical examination, laboratory tests, and X-rays were negative. The patient was not of a neurotic type.

The author concludes that the pain and sensory disturbances are due to some injury to the sensory root of the fifth nerve and not to middle ear or mastoid involvement, the visual defects being due to preexisting myopic astigmatism.—P. K. C.

INDUSTRIAL PHYSIOLOGY: NUTRITION, METABOLISM, FATIGUE, ETC.

RESUSCITATING THE "APPARENTLY DEAD." *G. R. C. Fisher. Manufacturers News, April 12, 1924, vol. 25, pp. 7-8.*

Unless a man is fatally hurt, there is a possibility of reviving him if proper treatment is given at once. Many men, apparently dead from some injury, are in a state of suspended animation and need artificial respiration properly administered.

The Schäfer or prone pressure method of resuscitation compels the diaphragm to carry on respiration until the paralyzed respiratory and brain centers are restored, when the heart and then the lungs "come back."

The author describes the prone method in detail and gives the following list of "don'ts" to remember:

Don't wait under any circumstances in starting the artificial respiration; time is a tremendous factor.

Don't stop the use of the Schäfer method to allow a mechanical apparatus to be used; nothing excels the manual method; if it doesn't succeed, no machine can, so hang on.

Don't surrender the body to an ambulance, unless the movement can be carried on *en route*.

Don't rub the limbs until the victim shows signs of reviving unless he is an illuminating gas victim.

Don't be too eager to give liquid stimulants upon reviving; give him time to get his breath.

Don't fail to watch him for hours after resuscitation: he may stop breathing again; if so, repeat the movement.—R. M. C.

HOURS OF WORK AND OUTPUT. *O. Lipmann. Internat. Labour Rev., April, 1924, vol. 9, pp. 481-506.*

The author presents a review of results obtained in different countries by reducing the hours of labor; he finds that but little appeal has been made to scientific knowledge. He concludes that from an exclusively economic point of view the problem is to retain not the maximum, but the optimum, hours of work; but these vary with industry, occupation, and individual capacity. Scientific research is needed to determine what this optimum is in each case; but results obtained in one country may not be applicable to another, since climatic conditions which influence working efficiency vary greatly in different lands. The introduction of any uniform maximum working-day can be justified only on social and ethical grounds, and not on those of production or health. Both production and health may suffer when hours are reduced if the worker indulges in excessive fatigue in his leisure time; if the worker is not well fed and does not receive an adequate wage; if the worker does not produce more per hour than before. The value of shortened hours can be enhanced by placing every man where his capacity enables him to produce best, and by interpolating scientifically arranged rest periods during the working-day.—E. L. C.

THE QUESTION OF A WEEKLY STOPPAGE IN GLASS WORKS USING TANK FURNACES. *Internat. Labour Rev., April, 1924, vol. 9, pp. 538-557.*

This article presents a summary of the position with regard to the manufacture of glass in various countries and discusses the advantages and disadvantages of introducing everywhere a complete Sunday rest. The author considers that the technical difficulties can be overcome; indeed, in some cases they are already being surmounted. The article deals with the technicalities of glass production and will prove of great value to any investigator carrying out research in the industry.—E. L. C.

WEEKLY SUSPENSION OF WORK FOR 24 HOURS IN GLASS-MANUFACTURING PROCESSES WHERE TANK FURNACES ARE USED. *Internat. Labour Conference, Sixth Session, Rep. 3, June, 1924, pp. 77.*

The third chapter of this report contains the text of a proposed draft convention which provides that work shall be suspended for twenty-four consecutive hours per week in glass-manufacturing industries except in processes in which (*a*) work must be continuous for technical reasons; and (*b*) preparatory and complementary work is necessary during the general rest period.

A list of the classes of work in which operations must be continuous is to be sent to the International Labour Office by each member. If revision is later necessary, the

member concerned should inform the Office.

Persons employed in continuous processes must be given a twenty-four-hour weekly rest by means of a system of rotation.

Temporary exceptions to the general weekly rest provision may be allowed in cases of accident, urgent work to be done to the plant, or *force majeure*. The employer must inform competent authorities each time this happens.—P. K. C.

NIGHT WORK IN BAKERIES. *Internat. Labour Conference, Sixth Session, Rep. 4, June, 1924, pp. 91.*

The proposed draft convention which the International Labour Office submitted for the consideration of the Conference states that, subject to exceptions mentioned, no work shall be carried on in bakeries during the night. (The terms "bakery" and "night" are defined.)

The exceptions are: (*a*) Preparatory and complementary work necessary outside working hours may be authorized for stated short periods only; (*b*) work may be done for a number of nights fixed by a public authority in agreement with employers' and workers' organizations; (*c*) the government may suspend the prohibition if public interest demands it; (*d*) night work may be done in cases of accident, actual or threatened, urgent work to be done to the plant, or *force majeure*.

Each state which ratifies this convention must take measures to enforce it by prohibiting the sale of new bread before a specified time or by other suitable means.—P. K. C.

HAZARDS OF COMPRESSED AIR, DIMINISHED PRESSURE, GENERATION AND USE OF ELECTRICITY, AND ELECTRICAL WELDING

REPORT OF SENIOR ELECTRICAL INSPECTOR. *Ann. Rep. Chief Inspect. Factories and Workshops for 1923. H. M. Stationery Office, 1924, pp. 82-88. Cmd. 2165.*

The use of electrical energy has enormously increased in the last ten years, yet where there were 472 electrical accidents with 19 fatalities in 1913, in 1923 there were only 361 with 21 fatalities. In thirteen cases of electric shock, consciousness was restored by artificial respiration after periods varying from as short as five minutes to as long as two hours; the last instance proves the value of long-continued treatment. In the accidents proving fatal, artificial respiration was carried on in one case for only two minutes and in another it was not attempted at all. Most accidents occurred on alternating current systems of low or medium pressure.—E. L. C.

VASCULAR LESIONS FROM LIVE WIRE. *Martin et al. Abstr. as follows from Lyon Chirurgical, Feb., 1924, vol. 21, p. 13, in Jour. Am. Med. Assn., April 12, 1924, vol. 82, p. 1230.*

Martin and his co-workers call attention to the disintegration in the media of the arteries injured—a primary mechanical vascular lesion which leaves the lumen intact. This explains the slowness of the development of the lesions in question, although they are liable to entail secondary hemorrhage, infections, and gangrene.—K. R. D.

HEAT, COLD AND HUMIDITY

VALUE OF THE KATA THERMOMETER IN EFFECTIVE TEMPERATURE STUDIES. *M. Ingels. Jour. Am. Soc. Heating and Ventil. Eng., June, 1924, vol. 30, pp. 453-456.*

It is shown that neither the wet nor the dry kata has equal cooling rates along one definite effective temperature line; therefore the author concludes that the kata-thermometer does not give a true index of comfort.

In determining equal comfort lines the instrument is of value as an anemometer, and in this capacity the dry kata is more accurate than the wet. (In this connection see THIS JOUR., 1924-1925, vol. 6, p. 20; also *ibid.*, Abstr. Section, p. 24.)—P. D.

CORRELATION OF SKIN TEMPERATURES AND PHYSIOLOGICAL REACTIONS. *W. J. McConnell*

and C. P. Yagloglou. Jour. Am. Soc. Heating and Ventil. Eng., June, 1924, vol. 30, pp. 457-463.

The authors used copper-constantan thermocouples enclosed in small glass tubes and measured the current by potentiometer as in their other studies. It is shown by curves that skin temperatures (cheek, abdominal, and dorsal) increase in definite relation to the effective temperature. If sufficient time is allowed to obtain conditions of equilibrium, the authors' results indicate that a constant skin temperature is attained. Plotting these temperatures against time gives a line which is approximately straight, thus allowing reasonably accurate estimates of skin temperature by extrapolation or interpolation. At high effective temperatures, such as 106, where the subjects were unable to remain in the test room for a full hour, extrapolated results were found to be unreliable. —P. D.

HUMIDITY RECORDERS. *E. B. Wheeler. Abstr. as follows from Bell System Tech. Jour., 1924, vol. 3, pp. 238-258, in Chem. Abstr., July 10, 1924, vol. 18, p. 1928.*

A Leeds and Northrup recorder is modified to read directly temperature and relative humidity. The circuit consists of three Wheatstone bridges, one of which contains the dry bulb resistance thermometer and controls the recording of temperature. Another Wheatstone bridge contains the wet bulb resistance thermometer. The third balances the resistances of the first two and controls the recording of relative humidity. The temperature record is correct to 0.25° F. and the humidity record to 0.5 per cent. This automatic apparatus may be used to control the functioning of *air conditioning* apparatus.—P. D.

WOMEN AND CHILDREN IN INDUSTRY

WOMEN IN ALABAMA INDUSTRIES. A STUDY OF HOURS, WAGES, AND WORKING CONDITIONS. *U. S. Dept. Labor, Women's Bur., Pub. No. 34, 1924, pp. 86.*

Hours

Alabama is one of five states in which there is no limit to the hours which women may work, either in one day or in one week, and it is one of thirty-two states in which there is no regulation of night work.

The lack of a state standard has resulted in a wide divergence in the number of hours required for a full working-day or week by various plants. Eight per cent. of the women worked not longer than eight hours on a shift; over 50 per cent. worked ten hours or longer. For 12.6 per cent. the normal working week was not more than forty-eight hours long; for 60 per cent. it was fifty-five hours or longer. For 13.2 per cent. the normal working week was at least sixty hours long.

In spite of the generally accepted theory that rest periods of ten or fifteen minutes in the middle of the morning and afternoon decrease fatigue, especially among women working at standing jobs, the schedules for the plants investigated showed that the value of such rest periods had not been appreciated in the women-employing industries of Alabama.

Sanitation

Lighting.—On the whole, natural lighting was well taken care of in textile mills, but was not so satisfactory in the laundries and stores. In one-fourth of the mills and factories there was a decided glare from artificial light, due to ineffective shades or to lack of shades. In laundries regulation of artificial light in regard to glare, rather than in regard to the amount provided, was needed. In thirty-two stores general artificial lighting satisfactorily shaded was reported; in only two cases was decided glare found.

Toilets.—Certain minimum requirements from the standpoint of health and comfort had been met for at least 50 per cent. of the women; for 17 per cent. no provision was made for washing; in 78 per cent. of the stores the women used common towels, and in 7 per cent. no towels were supplied.

Drinking Facilities.—While the sanitary bubbler method was found in a number of establishments, in thirty-nine plants no cup was provided, and in thirty-eight the employees used common drinking cups. Three plants supplied a bucket and dipper, and in

one the water was in a barrel which was refilled when necessary.

Working Conditions

Ventilation.—In some of the stores and mills the ventilation problem had been met in a satisfactory manner; while in others it was obvious that the air conditions had not been considered. In one laundry there were no electric fans, exhausts, nor heat deflectors over mangles; the windows and doors were closed; the humidity and heat were stifling, and steam hung in clouds against the ceiling.

In one large textile plant the windows were all closed, there were no electric fans nor exhausts, and the air was thick with lint. In one coarse-textile mill the lint lay in rolls on the floor or circulated like snow in the air.

Posture.—The Alabama law regulates seating only in retail stores. In the textile mills surveyed, a large proportion of the 3,485 women were employed in occupations in which it was necessary to stand while at work. Chairs with backs should be supplied for these women for use in stated rest periods and while they are waiting for material. In various mills the girls sat on window sills or leaned against posts, etc. Only one of sixteen mills employing weavers supplied chairs; seven supplied no seats whatever. Thirteen out of thirty-four mills employing spinners did not provide seats. Most of the mills furnished only an occasional seat without a back or else no seat at all.

In power laundries even less consideration had been given to posture. No seats whatever were provided for any of the workers in over two-thirds of the laundries.—C. N. J.

Women and Children in Pennsylvania Industries. *U. S. Month. Labor Rev., May, 1924, vol. 18, pp. 1050-1051.*

According to a study made by the Consumers' League of Eastern Pennsylvania, the number of female workers in Pennsylvania 10 years of age and over increased by 80,796 from 1910 to 1920, but the increase was not uniform throughout the industries. Agriculture and domestic and personal service showed a marked decrease in the number of women employed. Clerical occupations are rapidly becoming women's jobs; in the period 1910 to 1920, the number of women in clerical occupations increased 141 per cent.

"The most marked characteristic of the distribution of the wage earners in a 20-year period is the decrease in the number of children under 16 years of age employed in manufactures." The decline in the extent of child labor has been accompanied by an increase in the employment of women; the deduction is made that girls of 16 and over take the jobs formerly held by children under 16.—R. M. C.

Trend of Child Labor in 34 Cities in the United States, 1922 to 1923. *U. S. Month. Labor Rev., May, 1924, vol. 18, pp. 1046-1047.*

Of the thirty-four cities which furnished the Children's Bureau with statistics of employment certificate issuance in 1923, thirty reported an increase in the number of children under 16 years of age entering regular employment for the first time during the calendar year 1923 as compared with 1922. In fifteen of the cities there was an increase of at least 20 per cent., and in seven the increase was 50 per cent. or more.—R. M. C.

Child Labor Laws in Canada. *Am. Child, March, 1924, vol. 6, p. 5.*

Canada has no general legislation concerning child labor, but each province makes laws for its own children. The minimum age at which children are allowed to work in mines varies. The highest standards are in Ontario, which requires boys to be 18 before they can work underground, and 16 before they can work above. Practically all the provinces prohibit girls from everything but office work in the mines. Most of the provinces have a minimum age of 14 for work in factories, shops, and office buildings.—R. M. C.

Pennsylvania Children on New Jersey Cranberry Farms. *J. S. McKay. Pub. Educ. and Child Labor Assn. of Pennsylvania, Pub. No. 102, 1923, pp. 16.*

This report is the result of an investigation made by Miss McKay as field worker of the Public Education and Child Labor Association of Pennsylvania. The cranberry season lasts from six to eight weeks and requires an augmented labor force for a short period of time. The growers solve this problem by contracting with Italian padrones to

provide them with large gangs of Italian men, women, and children.

The hazards found were of chief concern to the children; among these may be numbered poor general working conditions, occasional cruelty toward children by the supervisory force, irregular hours of labor, and irregular methods of pay. As to living conditions generally observed, these were much below standard. Considerable overcrowding and poor hygienic conditions were found, with rarely any provision for organized recreation. Although little serious illness was discovered, there was considerable need for medical care which was not provided. Lack of school facilities was noted and the resulting interference with the educational progress of the children was stressed. The report concludes that there is one underlying cause, among others—namely, a tendency on the part of the unthrifty or greedy parents to shift as much as possible of the burden of family support from the father to the children.—H. B. E.

WORK OF CHILDREN ON TRUCK AND SMALL-FRUIT FARMS IN SOUTHERN NEW JERSEY. *U. S. Dept. Labor, Children's Bur., Pub. No. 132, 1924, pp. 58.*

This pamphlet is the result of a study made by the Industrial Division of the Children's Bureau and is the sixth of a series on rural child labor and the third of a series dealing specifically with the employment of children on truck farms.

As means of improving existing conditions the following measures are recommended:

1. The enactment of a minimum age law for farm workers and legal restriction of the hours of labor of such workers, especially children.

2. Some provision for better educational facilities for migratory juvenile workers and better enforcement of the compulsory school-attendance laws.

3. State supervision of housing. The sanitary conditions are in the main very poor and are in great need of being alleviated. There is also considerable overcrowding.—H. B. E.

THE WELFARE OF CHILDREN IN COTTON-GROWING AREAS OF TEXAS. *U. S. Dept. Labor, Children's Bur., Pub. No. 134, 1924, pp. 83.*

Texas has for many years produced more cotton than any other state in the Union, and in 1920 produced about one-third of the cotton crop of the country. The present study was made in two important cotton-growing counties selected because of different social and agricultural conditions.

Children in Resident Farming Families.—The child labor law of Texas prohibits the employment in industry of children under 15 years of age for more than ten hours a day, or forty-eight hours a week, but children engaged in farm work are specifically exempted from the provisions of the law.

Most children, both white and colored, begin doing field-work when very young. Forty-two per cent. of all the white children under 10 years of age and 26 per cent. of those under 8 years had worked in the fields. Many of the parents, although realizing the undesirability of overworking their children, were obliged to do so either because of labor shortage or because they could not afford to hire help. Even a 4-year old girl was obliged to help, by taking care of two babies, in order that the mother might work at cotton picking.

Besides picking cotton, the children also worked at planting, plowing, and harrowing. In certain counties some of the children worked eight months during the year.

The school term is for 115 days, and the law of Texas in effect at the time of the survey provided that every child between the ages of 8 and 14 years should attend school 100 days each school year. The law is, however, very defective in many respects and in a majority of the counties its enforcement is never seriously attempted. Exemptions were granted children over 12 years who had completed the fourth grade and whose services were needed for the support of their parents.

Children in Migratory Laborers' Families.—Cotton picking was practically the only kind of field-work done by these children. When the work was in progress, the average total number of hours worked by white children who went to the fields was 10.4 per day; the number worked by negro children was 10.7. Inasmuch as most of these children had few chores and little housework to do, the total number of hours which they worked differed only slightly from the number of hours spent in field-work. For the same rea-

son the average total hours of work per day was shorter for children in migratory families than for those in resident families. Workdays of great length continued a shorter time for children in migratory families than for those in resident families, the average duration for children in migratory families was 1.4 months.—C. N. J.

INDUSTRIAL SANITATION: FACTORY CONSTRUCTION, ILLUMINATION, VENTILATION, HEATING, WATER SUPPLY, SEWAGE DISPOSAL

NINTH REPORT OF ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION FOR THE YEAR ENDING 31ST MARCH, 1923. *H. M. Stationery Office, 1924, pp. 59.*

This report tells of further investigations carried out to perfect the jet dust counter (see THIS JOUR., 1922-1923, vol. 4, p. 522). Observations made on atmospheric pollution are given in detail for many districts in England and Scotland. Atmospheric impurities are found to travel great distances, and the haze often met with over the South of England is found to be produced in the manufacturing cities of the Midlands or even farther north. No further progress has been made in investigating the relation between atmospheric impurity and health. The matter, however, has not been entirely lost sight of. This, together with the relation of bacterial contents of the air to smoke contents, remains for further research.—E. L. C.

FURTHER STUDIES ON THE EFFECT OF COMPOSITION OF LIGHT ON IMPORTANT OCULAR FUNCTIONS. *C. E. Ferree and G. Rand. Tr. Illuminating Engin. Soc., May, 1924, vol. 19, pp. 424-447.*

In previous work (reported in 1921 by the same authors) results were given "showing the eye's acuity, speed of discrimination, and power to sustain acuity for spectrum lights of a high degree of purity, made equal photometrically at the test surface. The efficiency of the eye with regard to these three important functions was found to be greater in the mid-region of the spectrum than toward either end. Spectrum lights equalized as to brightness, however, show a considerable difference in saturation. It became important, therefore, to determine whether the difference in the results obtained should be ascribed to differences in saturation, or whether, for example, some hues are more favorable than others as a background for the discrimination of black test letters or printed characters. In the present investigation the spectrum lights were equalized both as to saturation and luminosity, and the tests repeated for the same observers. An advantage, not so great but still considerable, was found for the lights in the mid-region of the spectrum.

"The investigation was supplemented by the fatigue test used in the earlier investigations. That is, the power to sustain acuity was obtained before and after three hours of reading with the page illuminated by red, yellow, green and blue filtered lights (dipped lamps), equalized in luminosity and saturation at the point of work. A comparison of the results before and after reading shows that the eye held its power to sustain clear seeing best under the yellow light. The test surface and reading page were illuminated by the same light and were carefully matched for each color in hue, saturation, and brightness. A spectrophotometric analysis was made of the light reflected from the reading page. The yellow light was found by test also to show the least tendency to produce discomfort."

An interesting discussion of this paper is included. Exception was taken by Luckiesh to the low intensity of illumination used by Ferree and Rand; and Macbeth pointed out the general excellence of daylight. Ferree and Rand showed that the points raised by these gentlemen were not contradictory to the conclusions reached in this paper.—P. D.

EFFECTIVE TEMPERATURE APPLIED TO INDUSTRIAL VENTILATION PROBLEMS. *C. P. Yagloglou and W. E. Miller. Jour. Am. Soc. Heating and Ventil. Eng., July, 1924, vol. 30, pp. 515-539.*

This is a careful explanation, with excellent charts, showing the effect of air motion on the effective temperature scale. Using these charts

the authors give a number of examples of the cooling obtained by (1) air motion and (2) air motion plus the evaporation of water. It is shown that substantial cooling can be obtained by blowing warm air through fairly warm water. If this humidified air is then blown on workers engaged in hot occupations, conditions can be greatly improved. A number of practical problems are considered, and their solution is carried through by means of the above-mentioned charts.—P. D.

MODERN TREND IN THE SCIENCE OF VENTILATION. *P. West. Jour. Am. Soc. Heating and Ventil. Eng., June, 1924, vol. 30, pp. 421-438.*

This is a general discussion with particular reference to standards of ventilation. The author discusses equipment and standards obtainable in terms of E. V. Hill's Synthetic Air Chart. It is suggested that effective temperature data can well be utilized in determining these proposed standards. Data are given for schools, theaters, hospitals, and hotels in terms of cubic feet of air per minute per person and air changes per hour.—P. D.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

THE PHYSICIAN IN INDUSTRY. *J. J. Moorhead. Indust. Doctor, June, 1924, vol. 2, pp. 91-93.*

In this paper the author sketches the history of industry. He believes we are in the early stages of the human conservation phase of industrial progress where equal emphasis is being given to care of the human and of the metal machine. For the metal machine there is the engineer; for the human machine there is the medical engineer—the physician in industry.

He argues for the necessity of health work in industry and believes that this may be secured by engaging a capable physician and giving him suitable assistance and equipment. This physician should rank with the higher technical staff. The cost of medical service, he shows, is small according to the experience of the National Industrial Conference Board—about $4.43 per employee per year. The benefits to be derived include the physical appraisal of the workers and executives at the time of employment, control of epidemics, diminution of absenteeism and labor turnover, and improvement in general morale.—H. B. E.

LABOR'S PART IN HEALTH SERVICE. *S. Gompers. Hosp. Management, May, 1924, vol. 17, pp. 66-67.*

This article is part of a paper read before a meeting of the Conference Board of Physicians in Industry which was held in New York on April 4, 1924.

The author stresses the following points: (1) that organized labor was a pioneer in the field of industrial hygiene and, by protest and agitation, secured amelioration of harmful working conditions—abolition of tenement manufacture of cigars, the eight-hour day, etc.—with the result that the average life of union members has increased fifteen years; (2) that sound industrial relations must always be preserved, since there is danger that with development of the methods and practices of industrial hygiene the self-respect of the worker may be encroached upon; (3) that the preventive measures which industrial hygiene has made available are of great importance to the nation as well as to the individual worker, but that their advantages are not generally enjoyed because of the high fees, which debar the poor; and (4) that clinics should be organized under the joint auspices of industry, labor unions, and the United States Public Health Service or state boards of health.

The author urges finally "that industrial medicine avoid the errors of paternalism and that it be truly scientific not only as to the content of its professional field, but as to the performance of its practical service as an agent of management. The world pays tribute to the great ideal of the medical profession, service in the promotion of human welfare, and we are doubly anxious that in the development of new aspects of the profession that ideal shall be more sharply defined and given wider scope for benefaction."—H. B. E.

HEALTH FREQUENT CAUSE OF DISPUTE. *H. S. McCauley. Hosp. Management, June, 1924, vol. 17, pp. 64-65.*

"Fair adjustment of all grievances, pensions for the aged and disabled, medical service for those injured in the line of duty in accordance with compensation law of Illinois, the services of the plant physicians to employes in case of sickness on the plant and in the home if the employe requests it, disability payments.

"These features form the backbone of the welfare and medical work of Swift and Company, Chicago packers."

The matter of grievances is taken care of by the "employes' representation plan" which provides for a general assembly formed of equal numbers of employees' representatives and representatives of the management. The most frequent cause of dispute between the management and the employees is that relating to plant practice protest; with health and comfort and accommodations for employees coming second and third, respectively.

The remainder of this paper deals with the details of the different services rendered the employees by Swift and Company.—H. B. E.

WHAT A MEDICAL DEPARTMENT IN INDUSTRY ACTUALLY DOES. *W. I. Clark. Indust. Doctor, June, 1924, vol. 2, pp. 87-90.*

In this paper Dr. Clark groups the activities of a medical department in industry under four headings: (1) physical examinations; (2) treatment of accidents; (3) prevention of sickness, including the treatment of minor ills in order to prevent their becoming serious; and (4) sanitation and hygiene of the entire plant.

Medical work in industry deserves a place in the factory organization because it is economically sound—it favors production, reduces labor turnover, etc. To be successful it must be popular with the employees; and success in industrial medical practice depends upon the ability of the physicians and the completeness and accessibility of the dispensary.

In Dr. Clark's plant there are three hospitals (one central and two subsidiary), each in charge of a nurse. There is a physician, also, at the central hospital. Three hospitals are necessary because the plant is spread over a large area. On an average, 125 to 135 visits a day are made to these hospitals.—H. B. E.

THE NEED OF PERIODIC PHYSICAL EXAMINATIONS FOR EXECUTIVES. *E. L. Fisk. Safety Engin., May, 1924, vol. 47, pp. 238-239.*

It is too commonly supposed that a man in a high executive position is immune to the physical vicissitudes; as a matter of fact, however, chronic infections and badly functioning organs produce unfavorable reactions on the conduct of business. Such men should have thorough and critical physical analyses of their bodies and lives at least once a year and should be checked up on special points in the intervals between examinations as often as necessary. After providing for a million dollar life insurance policy to be taken out on the life of an important executive, to make no provision for extending the period of his usefulness is almost ludicrous.

Where a reasonable health supervision has been put into effect, the death rate between the ages of 50 and 60 has been cut down more than 50 per cent.—B. A.

FEET, FLOORS AND HEALTH. *A. B. Emmons. Nation's Health, March, 1924, vol. 6, pp. 171-172.*

A summary of conditions affecting foot comfort. The following points are discussed: the effect of proper posture, the nature of the floor covering, and the necessity of properly fitting shoes.—G. B. R.

INDUSTRIAL INVESTIGATIONS AND SURVEYS

LIVING CONDITIONS OF BITUMINOUS MINE WORKERS. *U. S. Monthly Labor Rev., March, 1924, vol. 18, pp. 529-535.*

This article is based upon a study made by a subcommittee of the United States Coal Commission. Surveys of the physical environment and community resources of the mining towns were made by a staff of field agents in 880 communities, 713 of which were controlled by companies, while 167 were independent. Sanitary surveys which covered a wide range of sanitary conditions were

made by the United States Public Health Service in 123 communities; 64 were company controlled and 59 were independent. Retail prices and rents were studied in selected districts and family budgets secured. In addition, a tabulation of the characteristics of the mining population, that is, their human requirements, was made from the schedules collected by the Bureau of the Census in 1920.

One important point stressed by the report is that once a mine is opened, the work must be done on the spot, and when the coal in that place has been mined, work there comes to an end and the workers must go elsewhere. The results are that the homes of the miners are temporary and the workers tend to live far from any normal center of population. It is also shown that miners are probably more dependent upon their employers for their homes and the conditions under which they work than is any other large group of workers.

There are nearly 600,000 workers in the bituminous coal mines scattered over twenty-eight states; 70 per cent. live in a 900-mile strip extending from northern Pennsylvania, through Ohio, West Virginia, Maryland, Virginia, eastern Kentucky, and Tennessee, to central Alabama; 20 per cent. are in the states of Indiana, Illinois, Iowa, Missouri, Oklahoma, and Kansas.

Although considerable variation in housing conditions is shown there is ample room for improvement. The same may be said of the general sanitary conditions. In the majority of communities, the facilities for recreation and amusement were meager. A rating schedule to indicate the relative status of the communities was devised with the following results: Nine per cent. of the 713 towns studied scored 75 or better out of a possible 100 points; 11 per cent. scored under 50; and 80 per cent. scored between 50 and 75.

As to the cost of living, the following statement is made: "In general, wherever independent mining towns predominate, prices on all items except coal correspond with prices in wage-earning sections of near-by industrial cities. In localities where company-controlled communities prevail, prices of food are usually higher, but rents and costs of fuel are lower."

The article concludes that conditions in mining camps are not usually such as to make for stable, responsible citizenry. The change from company-owned camps to independent communities must be evolved as mining districts develop diversified industries.—H. B. E.

RAILROAD MALARIA SURVEYS, 1922. THE MISSOURI PACIFIC RAILROAD. *A. S. Fuchs. U. S. Pub. Health Bull. No. 135, 1923, pp. 36.*

This report presents the results of a malaria survey conducted during 1922 by the United States Public Health Service in co-operation with the Missouri Pacific Railroad Company and the state health officers of Arkansas and Louisiana for the purposes of determining the prevalence of malaria among employees of the Missouri Pacific Railroad, of ascertaining the effect of malaria on operating costs and railroad revenues, and of making proper recommendations to the railroad for the economical control of this disease.

During the past twenty-three years the number of employees given hospital treatment for malaria averaged 1,000 annually, constituting 33 per cent. of all hospital admissions and 45 per cent. of all sickness cases. For the same period injuries and surgical cases combined totaled only 75 per cent. of malaria admissions. In addition, over 4,000 employees received outpatient treatment for malaria each year.

With the subnormal personnel of 1920, the cost of hospital treatment for malarial employees that year was over $25,000. Statements from railroad foremen indicate that malaria constitutes an enormous charge against the cost of operation by reducing the efficiency of labor, by producing a shortage of labor, and by creating a high labor turnover. Employees on malarious divisions are dissatisfied on account of frequent illness in the family and the excessive expenditures for medical attention.

Recommendations for a railroad malaria control program include: (1) protection of employees by methods most applicable to their mode of living; and (2) co-operation with state and local health departments in the inauguration of anti-mosquito campaigns in cities, mill towns, and farming communities on the line of the Missouri Pacific Railroad. —M. C. S.

WAGES AND HOURS OF LABOR IN THE IRON AND STEEL INDUSTRY: 1907 TO 1922, *U. S. Bur. Labor Statistics, Bull. 353, April, 1924, pp. 174.*

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

WHAT IS PERSONNEL RESEARCH? *L. L. Thurstone. Jour. Personnel Res., June, 1924, vol. 3, pp. 52-56.*

"A clear definition of what personnel aims at and also a statement of the essential method employed in all scientific personnel investigations is set forth in this paper by Dr. Thurstone. It was originally prepared for presentation before the American Political Science Association, which met at Columbus, Ohio, December 29, 1923, and illustrates how the young science of psychology is interrelated with other social sciences."

After stating that "every scientific problem is the search for the functional relation between two or more variables," Dr. Thurstone proposes that "personnel is the study of the relation between *working* and *living*," and that personnel research is the application of the experimental method to solve problems in the field of personnel. Among these are problems in employment, placement, training, and promotion; analyses of jobs in relation to aptitudes; classification of positions, pensions, etc.—H. B. E.

THE SELECTION OF ENGINEERING APPRENTICES. *M. Tagg. Jour. Nat. Inst. Indust. Psychol., July, 1924, vol. 2, pp. 129-133.*

A series of psychologic tests has been carried out for the selection of "trade" apprentices in the engineering industry. The specific abilities essential in each of the trades—such as turning, fitting, pattern-making—have been analyzed, and the boys fitted for engineering work have been sorted and graded according to the trade which they could enter to the best advantage. In testing for specific abilities, factors such as motor ability and dexterity, mechanical ingenuity, perception and memory of form were measured. The other factors taken into account included the level of general intelligence (as tested by the Institute's group tests) and the level of general education required in the trade (which is above the normal average of the entire population). The individual tests applied with good results included cube building, form building, drilling machine tests, lathe test, assembly test, and wire bending test.—H. M. V.

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

MINERS' WELFARE FUND. *Second Annual Report for 1923. H. M. Stationery Office, pp. 37.*

This second report upon the administration of the Miners' Welfare Fund in Great Britain displays the whole scheme in full swing. Allocations and receipts for the year reached the same sum—namely, £1,000,000; still there remains, from previous receipts, a substantial sum to the credit of the Fund. An outstanding point is the economical administration, the cost of which hardly reaches 0.5 per cent. The Committee does not consider that the climax of its activities has yet been attained, but finds its policy curtailed by the five and one-half year limit of the Act under which the Fund is raised. Both sides of the coal mining industry, owners and miners, however, appreciate what has already been accomplished, and a continuance of the Fund beyond the original period contemplated may confidently be expected. Recreation schemes in mining areas, including athletic grounds, public parks and institutes, have continued to draw most from the Fund, but expenditure on health, including hospitals, convalescent homes, nursing ambulance services, and pithead baths, is steadily increasing; thus, whereas in 1922 recreation schemes obtained four times as much as health, in 1924 they received little more than twice as much. The Committee, struck by the scarcity in the country of pithead baths, notwithstanding their value for insuring both health and efficiency, offers increased support from the Fund for their erection, and gives an excellent design for baths which embodies novel ideas and economy in construction. The position of education under the Fund is carefully discussed; it has proved a difficult matter; a comprehensive scheme is needed and is being adopted. Immediate progress in this direction during 1924 will certainly be reported.

The report concludes with twelve useful

appendices, of which the most attractive is the wonderful convalescent home, Talygarn House, in South Wales, a noble mansion standing in beautiful and spacious grounds; it accommodates 100 convalescents, and the total cost, including running expenses, has been endowed from the Fund.—E. L. C.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

Labor Law of Durango, Mexico. *E. C. Yohe. U. S. Month. Labor Rev., April, 1924, vol. 18, pp. 883-894.*

This law covers a great variety of subjects. Among those of particular interest to industrial hygienists are:

Hours of Labor and Rest.—The maximum eight-hour day is established in every kind of day work. Overtime is strictly regulated. Minors cannot be employed at night work or overtime. Women cannot be employed after 10 p. m. The maximum working-day for children 12 to 14 years of age is four hours; for children 15 and 16 years of age and for pregnant women, six hours.

Fixed rest periods in the working-day other than meal times are provided. Sunday is an obligatory rest day where possible; when it is not, a week day must be substituted. January 1 and September 16 are obligatory holidays. All workers employed over one year receive fifteen days' vacation with pay.

Hygiene and Safety.—Persons employing over 100 men must furnish comfortable, sanitary dwellings at a regulated rental and with necessary community services. Gambling and liquor saloons are prohibited.

Adequate measures for accident prevention and safety instruction are required. Great care must be exercised in the handling of poisonous materials. Measures for the prevention of malaria and infectious disease must be taken in insanitary regions. First-aid treatment and necessary medicine must be provided in cases of accidents to workers.

Workers must abstain from imprudent acts, help without overtime pay in cases of grave danger in the plant, advise superiors of flaws in machinery, and never clean nor oil machines which are in motion.

Workmen's Compensation.—Employers are liable for industrial accidents and occupational diseases arising out of employment. The employments included in the law are cited, as well as the injuries covered and the compensation benefits.—P. K. C.

Workmen's Compensation. *Internat. Labour Office, 1924, pp. 55.*

The general problem of legislation on workmen's compensation is to be dealt with at the seventh session of the International Labour Conference.

The subjects considered in the tentative questionnaire to be sent to the governments include the sphere of application of rules, beneficiaries under rules, the handling of industrial accidents and occupational diseases, the form of compensation payments for incapacity or death, the amount of compensation for incapacity, medical benefits, security of payment and insurance, and administration and settlement of disputes.—P. K. C.

Equality of Treatment for National and Foreign Workers As Regards Workmen's Compensation for Accidents. *Internat. Labour Conference, Sixth Session, Rep. 2, June, 1924, pp. 109.*

The proposed draft convention which the International Labour Office submitted for the consideration of the Conference is based on replies received from the governments in answer to a questionnaire.

Article 1 provides that each member of the International Labour Organization which ratifies the convention shall grant the same treatment in respect to workmen's compensation to workers who are nationals of any other member which ratifies the convention and who suffer personal injury by industrial accident in its territory that it grants to its own nationals.

Article 2 provides that, in the case of compensation to be paid to workmen injured while employed temporarily in the territory of one member in behalf of an undertaking situated in the territory of another member, the laws of the second member may govern.

Article 3 provides that the members ratifying the convention shall undertake to afford each other mutual assistance in its application.—P. K. C.

Cotton-Spinners' Cancer. *Lancet, Aug. 2, 1924, vol. 2, p. 239.*

Judgment has now been given in the important claim for compensation by an operative mule-spinner (see This Jour., 1924-1925, vol. 6, Abstr. Section, p. 47). It was alleged that he had contracted epithelioma of the scrotum in the course of his employment. The point at issue was whether the disease was contracted in the course of employment and was one for which he should be compensated. The judge held that the applicant was entitled to compensation for personal injury by accident or disease arising out of and in the course of his employment within the meaning of the Workmen's Compensation Act, 1906. He summed up as follows:

1. The applicant contracted the disease known as cancer of the scrotum.

2. This disease manifested itself for the first time while he was employed by the respondents who were his last employers.

3. His employment brought him in contact with a moving bar which caused constant friction close to the scrotum.

4. His employment was such that his overalls near the scrotum were constantly sprinkled with mineral oil.

5. Mineral oil is an irritant.

6. The applicant, when at work, used overalls which could be easily penetrated by the oil.

7. The atmosphere in which he worked was humid.

8. Investigation has proved that cancer of the scrotum is quite common among mule-spinners.

9. Combine the facts one to seven and the conclusion is irresistible that there is a connection between the disease and the employment, and I so hold.

The case was regarded as a test case, and much importance is attached to the judgment, having regard to the fact that many more claims may depend on it.—E. L. C.

Old-Age and Invalidity Pensions of French Miners. *U. S. Month. Labor Rev., April, 1924, vol. 18, pp. 879-880.*

The miners retirement law in France has been recently amended. The pension fund is administered by a council of representatives of the state, mine operators, and workers, and is supported by money from these three sources in definite ratios.

Employees, to be eligible for retirement, must be 55 years of age and must have had at least thirty years of service in the mines. The minimum pension in these cases is 2,000 francs ($386, par). Pensions paid to persons who have worked for less than the full period of thirty years cannot be less than 600 francs for fifteen years of service nor more than 1,500 francs for twenty-nine years of service.

Payments are made to miners with a permanent partial disability amounting to two-thirds of their working capacity after they have received assistance from any insurance society for six months, provided they have had ten years of service with at least 500 days of effective labor in the two years preceding incapacity.

Provisions are also made for widows and orphans under 16 years of age.—P. K. C.

ABSTRACT OF THE LITERATURE
OF
INDUSTRIAL HYGIENE

VOLUME VI DECEMBER, 1924 NUMBER 8

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GENERAL

AIMS OF DIVISION OF INDUSTRIAL HYGIENE OF NEW YORK STATE DEPARTMENT OF LABOR. *L. E. Cofer. Jour. Am. Med. Assn., July 26, 1924, vol. 83, pp. 257-259.*

This paper is a plea for the co-operation of employers and employees with the New York State Department of Labor in order that a corps of industrial hygiene experts may be gradually organized to whom medical men, employers, and employees could refer their problems, with the result that in time the regulations or the procedure governing the hygiene of industry could be modified or adjusted to suitable standards.—K.R.D.

NOTIFICATION OF OCCUPATIONAL DISEASES. *Paris Letter, Jour. Am. Med. Assn., June 14, 1924, vol. 82, p. 1981.*

The act of October 25, 1919, brought occupational diseases, from the standpoint of occupational hazard, into the same category as industrial accidents. This law contains a twofold declaration: (1) Every occupational disease for which the sufferer demands indemnification must be reported to the mayor of the commune within fifteen days of cessation from work. (2) Certain occupational diseases must be notified by any physician who recognizes them. The list of notifiable diseases includes the most typical and the most frequent forms of intoxication resulting from lead or mercury. The law in question did not go into effect until 1921. In that year the number of notifications reached 148,

fifty-three of which emanated from physicians, eighty-nine from the patients themselves, and six from both physicians and patients. The year 1922 was marked by a noteworthy increase, evidently due not to an aggravation of insanitary conditions but rather to a more general adherence to the law, owing to the fact of its having become better known. Eight hundred and five notifications were sent in to the ministry of labor, 274 being received from physicians, 448 from the persons afflicted, and eighty-three from both. Plumbism was at the basis of 144 cases out of 148 notified in 1921, and of 797 cases out of 805 reported in 1922. The adjoined table shows the trades in which lead causes the most damage.

Distribution of Cases of Plumbism

	Number of Cases Notified	
	1921	1922
Manufactories of enamel ware	53	286
Accumulator factories	18	180
White lead and minium factories	5	94
Painting of various kinds	13	64
Metal foundries	12	35
Printing establishments	10	22
Chemical products, dyes	4	23
Factories of glass and crystal ware	6	19
Layers of sheet metal; lead workers	4	15
Various industries	19	59
Totals	144	797

From the standpoint of diagnosis, the manifestations of plumbism were much diversified:

	1921	1922
Ordinary lead colic	98	559
Lead colic, with anemia	7	27
Lead colic, with rheumatism, tremor and paralysis	6	35
Saturnine anemia, with or without motor symptoms	2	14
Nephritis	3	21
Rheumatism	..	8
Miscellaneous (arteriosclerosis, cirrhosis of the liver, hepatitis, enterocolitis, etc.)	12	27
Uncertain diagnosis	16	106
Totals	144	797

In a recent number of the *Gazette hebdomadaire des sciences médicales de Bordeaux*, M. J. Cavaillé, inspector of labor, notes with regret that the value of the notification of occupational diseases still remains unrecognized by many physicians, since 59 per cent. of the cases notified in 1921 and 56 per cent. in 1922 were not reported directly by the attending physician but by the patients themselves. However, if notification were carried out regularly, it would be possible to establish complete statistics which would have authoritative value in regard to cases of disease caused by the two main industrial poisons: lead and mercury. All the informational factors that enter into the problem of plumbism and mercurialism, such as case incidence, the risks characteristic of each trade, the essential symptoms and the clinical types of the disease, the gravity and duration of resulting incapacity, would thus be verified and brought up to date. The value would be no less from the preventive point of view, for such statistics would furnish the means of charting the various trades and industries from the standpoint of the intoxication menace. It would make it possible to set the limits of insanitary zones created by the use of lead and mercury, and would give us a more exact basis for a campaign of prophylaxis.—K.R.D.

SYSTEMIC OCCUPATIONAL DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

CENTRAL NERVOUS SYSTEM

CHANGES IN THE NERVOUS SYSTEM IN WORKERS IN THE TOBACCO INDUSTRY. *A. Neiding. Abstr. as follows from Deutsch. Ztschr. f. Nervenh., vol. 81, no. 5-6, in München. med. Wchnschr., April 18, 1924, vol. 71, p. 534.*

The author's investigations showed that tobacco smoking and work in the tobacco industry give in general the same picture of nicotine poisoning which, in comparison with other poisons, is of an insignificant nature. In addition to causing nervous symptoms, nicotine seems to exert a toxic effect on the glands of internal secretion, especially the thyroid gland.

J. I. H.
Dec., 1924

RESPIRATORY SYSTEM

ASTHMA DUE TO GRAIN RUSTS. *F. T. Cadham. Jour. Am. Med. Assn., July 5, 1924, vol. 83, p. 27.*

This is a brief note, including the report of a case, on asthma due to the inhalation of rust fungi on grain or on infected straw. Wheat, barley, oats, and rye are hosts for special rusts, and in certain sections of the northwestern states and western Canada so many plants are infected that it is not uncommon to see binders working in the grain fields enveloped in a cloud of rust spores.

Rust fungi are wind borne, and in grain-growing sections of the country they should be considered as possible causes of asthma or hay-fever.—K.R.D.

POISONOUS HAZARDS AND THEIR EFFECTS: GASES, CHEMICALS, ETC.

FUMES IN THE CHEMICAL INDUSTRY IN RELATION TO THE HYGIENE OF THE WORK AND TO THE PUBLIC. *U. Pomilio. Abstr. as follows from Atti congresso naz. chim. pura applicata, 1923, pp. 372-383, in Chem. Abstr., Sept. 20, 1924, vol. 18, pp. 2928-2929.*

An extended discussion of the present status of the Italian chemical industries with respect to the hygienic welfare of the workers and the public. Preventive means both through legal measures and through equipment, such as electrostatic purification, are included.—P.D.

POISONS RELEASED IN MELTING PLATINUM HARDENED WITH OSMIUM. *C. M. Hoke. Abstr. as follows from Jewelers' Circular, Brass World, 1924, vol. 20, p. 242, in Chem. Abstr., Sept. 10, 1924, vol. 18, p. 2673.*

Even the gentle heat used in annealing platinum is enough to drive off poisonous osmium fumes. There are indications that the proportion of osmium used in jewelry metal may be expected to increase steadily.—P.D.

OCCUPATIONAL BENZOL POISONING. *F. Heim et al. Abstr. as follows from Presse méd., June 7, 1924, vol. 32, p. 497, in Jour. Am. Med. Assn., July 26, 1924, vol. 83, p. 309.*

Heim and his co-workers report thirty cases of chronic intoxication with benzene which is used as a solvent in rubber industries. The symptoms may be from the digestive apparatus (congestion of the buccal mucosa, benzol odor on the breath, gastric cramps); disturbances of a cardiovascular nature (hypertension, aortic atheroma, nosebleed), and, especially, nervous symptoms (headache, dizziness, irritability, weakness). They emphasize that eosinophilia is frequent in these cases, and the number of polymorphonuclears is normal or slightly diminished. Preventive measures consist in suction exhaust ventilation carrying off the fumes. The young and women are most susceptible.—K.R.D.

CARBON MONOXIDE IN CEMENT PLANTS. *Travelers Standard, June, 1924, vol. 12, pp. 121-123.*

In this article a report of an accident which occurred recently in a cement plant in Alabama is given. Two men had been detailed to clean off some powdered coal which had stuck to the sides of a coal bin. One went into the bin and shortly afterwards he was seen to fall over apparently unconscious. The second man having called for assistance, immediately went down into the bin to help his companion but was also rendered unconscious. Neither of these men had ropes secured to them when they entered the bin. The third man, provided with a gas mask and a rope, attempted a rescue. He was able to fasten a rope to the legs of one of the unconscious men but he also was overcome. Another volunteer tied a wet handkerchief over his nose and mouth and was lowered into the bin by means of a rope. He also lost consciousness but was able to attach a rope to the first man who went into the bin. Eventually all four men were hoisted out. The first two men to enter the bin died, but the other two recovered after a short time. These deaths were probably caused by carbon monoxide gas which had been generated by the partial oxidation of the coal and had collected in the bin. It is advised that in situations such as the one here described *special-*

ly designed gas masks should be used and that no one should ever enter a coal bin or enclosure without one.—H.B.E.

CARBON MONOXIDE POISONING IN PRIVATE GARAGES. *W. P. Yant, W. A. Jacobs, and L. B. Berger. Indust. and Engin. Chem., Oct., 1924, vol. 16, pp. 1047-1049.*

In summing up the dangers arising from running an automobile engine in a closed private garage it can be said that, owing to (1) the rapidity with which toxic concentrations can be created, as shown by the curves in this report for the average automobile; (2) the fact that the gas may be more concentrated in the vicinity of the man exposed—say, in the rear of the car or under it; (3) the uncertainty that the engine in question might be adjusted to give off as much as 50 per cent. more carbon monoxide than the average; (4) the varying sizes of garages (some being as small as 1,000 cubic feet capacity or less) and the ventilation; (5) the differences in the susceptibility of men, together with the increasing effect of exercise on the absorption of carbon monoxide; (6) the lack of warning symptoms—headache, nausea, etc.—in the case of exposure to these high concentrations, and the possibility of sudden collapses; there seems to be no limit of time during which the engine may be run in a closed private garage with safety to an occupant thereof.

Curves and formulae are given showing the rate of accumulation of carbon monoxide resulting from running an automobile engine in small garages of known rates of ventilation.—P.D.

CARBON MONOXIDE POISONING IN HOMES AND INDUSTRIES. *R. R. Sayers. U.S. Bur. Mines, Rep. Investigations, Serial No. 2593, April, 1924, pp. 8.*

Automobile exhaust gas—an average of tests on 101 cars of all types—contains 7 per cent. carbon monoxide; a gas range burning natural gas gives off 0.2 per cent. carbon monoxide; a room heater burning natural gas, 0.5 per cent.; carbureted water gas, 30 per cent.; and coal gas, 16 per cent. Twenty-three other commercial gas mixtures containing carbon monoxide were analyzed and the results are given in the table from which the foregoing figures are quoted.

Carbon monoxide from room heaters and gas ranges burning natural gas has caused poisoning and death of many people and is still doing so on account of improper design, adjustment, lack of room ventilation and venting of the stove to allow the escape of the products of combustion. A closed room in which a man was found unconscious in bed with an unvented gas heater burning contained 0.256 per cent. carbon monoxide after four hours. When the man was found, tests showed that 80 per cent. of the hemoglobin of his blood had combined with carbon monoxide. He recovered.

Running the motor of an ordinary touring car at idling speed for twenty minutes in a closed garage having a capacity of approximately 3,000 cubic feet liberated enough carbon monoxide to cause a dog sitting on the driver's seat to fall to the floor unconscious. The air at this time contained 1.3 per cent. carbon monoxide, which is sufficient to cause death within a few minutes.

Birds are more quickly affected than man by carbon monoxide and may be used for detecting dangerous atmospheres. In general, birds show signs of distress when exposed for sixty minutes to 0.1 per cent. and when exposed for two to five minutes to 0.2 per cent. carbon monoxide.

Activated iodine pentoxide indicator gives immediate positive results for carbon monoxide above 0.07 per cent.

The only infallible test for detection of carbon monoxide poisoning is by examining the blood for carbon monoxide hemoglobin. A method and an apparatus for this test have recently been developed by the Bureau. By its use a small amount of blood (0.1 c.c.) can be quantitatively examined in a few minutes for carbon monoxide and a true diagnosis made. This test permits detection of low concentrations of carbon monoxide to an accuracy of 0.01 per cent. The apparatus is simple, portable, and compact; and the making of determinations requires no special skill. The affinity of carbon monoxide for hemoglobin is about 300 times that of oxygen; hence the extremely dangerous action on the body from the displacement by carbon monoxide of oxygen from its combination with hemoglobin.

The symptoms of carbon monoxide poisoning are given in detail.

The successive steps in effective treatment of acute carbon monoxide poisoning are:

1. Remove the victim to fresh air as soon

as possible.

2. If breathing has stopped, or is weak and intermittent, or present in only occasional gasps, administer artificial respiration by the Schäfer method until normal breathing is resumed, or until after the heart has stopped.

3. As soon as possible administer pure oxygen, or a mixture of 5 per cent. carbon dioxide in oxygen, for twenty minutes or more.

4. Aid circulation by rubbing the limbs and keeping the body warm with blankets, hot-water bottles, etc. This aids in tiding the body over a period of low vitality. Other stimulants should not be administered except by a physician.

5. Keep the patient at rest, lying down in order to avoid strain on the heart. Later, he should be treated as a convalescent and given plenty of time to rest and recuperate.

6. After-effects of carbon monoxide poisoning should be treated symptomatically.

A Source of Lead Poisoning. *Beintker. Abstr. as follows from Deutsch. med. Wchnschr., July 11, 1924, vol. 50, p. 958, in Jour. Am. Med. Assn., Aug. 23, 1924, vol. 83, p. 650.*

Beintker observed lead poisoning in a plant for hardening of wires. The steel wires are heated to 800°C. and cooled in a lead bath of about 500°C.—K.R.D.

The Solubility of Various Lead Compounds in Blood Serum. *L. T. Fairhall. Jour. Biol. Chem., July, 1924, vol. 60, pp. 481-484.*

The solubilities of metallic lead, lead oxide, lead sulphate, lead carbonate, and lead oxide in serum were determined by mechanical shaking in a thermostat at 25° C. until equilibrium was reached. There is no great increase in the solubility of lead salts in serum as compared with that in pure water. When saturated with carbon dioxide, the solubility of lead carbonate in serum is slightly reduced. Lead oxide and metallic lead are surprisingly soluble in serum—a probable factor in the acutely toxic effect of lead oxide dust and lead fume.—L.T.F.

Analyzing Urine for Lead. *L. T. Fairhall. Abstr. as follows from Jour. Biol. Chem., July, 1924, vol. 60, p. 485, in Jour. Am. Med. Assn., Aug. 30, 1924, vol. 83, p. 713.*

An entrainment reaction has been applied by Fairhall to the precipitation of lead from urine. Lead is quantitatively precipitated with the alkaline earth phosphates when ammonium hydroxide is added. This precipitate can be collected, ashed, and the amount of lead present determined volumetrically with greater facility than by the usual method of evaporating the urine to dryness and ashing the residue.—K.R.D.

Lead Studies. III. The Effects of Lead on Red Blood Cells. Part 1. Changes in Hemolysis. *J. C. Aub, P. Reznikoff, and D. E. Smith;* Part 2. Surface Phenomena and their Physiological Explanation. *J. C. Aub, P. Reznikoff, and D. E. Smith;* Part 3. A Chemical Explanation of the Reaction of Lead with Red Blood Cells. *J. C. Aub and P. Reznikoff. Jour. Exper. Med., Aug., 1924, vol. 40, pp. 151-208.*

The following general summary is given:

These three papers have developed the following facts, which suffice to explain completely the anemia of lead poisoning.

In vitro, the exposure to a very small amount of lead greatly changes the surface of the red blood cells. Their permeability to water is so altered that they shrink and are incapable of swelling as much as normal cells. With this is associated a marked increase in the resistance to different osmotic surroundings—demonstrated by far less hemolysis than normal in salt solution of very low concentrations. The "leaded" cells, however, are relatively short lived, and hemolyze readily as the result of slight trauma. These observations can also be demonstrated *in vivo* as experiments with rabbits with acute lead poisoning show. In addition to these effects on permeability, lead alters the physical properties of red blood cells so that they lose their normal stickiness and are no longer agglutinated by the sera of different iso-agglutinating groups. All these changes are evidence of an effect on the surface of the cell; the interior of the cell does not undergo disturbances; at least, the physiologic properties of the hemoglobin remain normal. The chemical reaction which causes these physical changes in the cell is a precipitation of insoluble lead phosphate and a formation of acid.

This causes the "leaded" red blood cell to change from an elastic distensible sac, to one which is contracted, relatively inelastic and brittle. In such condition the cell can poorly withstand the trauma involved in circulation of the blood, and this lack of resistance probably explains the marked destruction of peripheral blood in lead poisoning.

Bronchial Asthma and Other Allergic Manifestations in Pharmacists. *M. M. Peshkin. Jour. Am. Med. Assn., June 7, 1924, vol. 82, pp. 1854-1855.*

The conclusions derived from this paper are as follows:

1. Sensitization to drugs is more common than one is led to believe from the few reports in the literature.

2. Ipecac is the most common cause of bronchial asthma in pharmacists and pharmaceutic workers.

3. Next to ipecac, the commonest causes of bronchial asthma in pharmacists are podophyllin and pokeroot.

4. The handling of emetine solution and vanilla beans causes skin manifestations characterized by urticaria of the forearms and hands, with intense itching.

5. Synthetic drugs and desiccated animal gland extracts apparently play no rôle in the causation of bronchial asthma, except that by inhalation they may induce an asthmatic attack by mechanical irritation.

6. Rhubarb and lycopodium hypersensitiveness are unusual causes of allergic manifestations in pharmacists.

7. The occupations of pharmacist and pharmaceutic worker and their relation to bronchial asthma and other allergic manifestations due to drugs are important, it would appear, and deserve more attention.—K.R.D.

Prohibition of the Use of Both White and Yellow Phosphorus for Matches. *Bucharest Letter, Jour. Am. Med. Assn., Aug. 2, 1924, vol. 83, p. 371.*

There came into force, July 1, a law that prohibits the use of both white and yellow phosphorus in the manufacture of matches. Their importation from other countries and their sale are also forbidden. The prohibition is suspended only with relation to the lighting cords used in mines for safety lamps. This new law is the result of repeated urging by the medical board of the workmen's insurance office, which has to support for the remainder of their lives hundreds of workmen who have become incapacitated on account of phosphorus poisoning. One of the wards of the surgical section of the university clinic had always many cases of phosphorus necrosis, the destruction of tissue being mostly so extensive that treatment was of no avail. —K.R.D.

Dangers of Wireless Telegraphy. *Axmann. Abstr. as follows from Deutsch. med. Wchnschr., April 18, 1924, vol. 50, p. 514, in Jour. Am. Med. Assn., May 31, 1924, vol. 82, p. 1825.*

Axmann observed in the personnel of a wireless telegraph station a loss of hair on the side of the head which was exposed for months to the apparatus. He believes that the electronic tubes acted like a weak roentgen tube.—K.R.D.

DUST HAZARDS AND THEIR EFFECTS

Annual Report of the South African Institute for Medical Research for the Year Ending December 31, 1923. *Johannesburg, 1924.*

The work summarized in this report covers a wide field of activity; only a portion of it—that dealing with experimental infective silicosis—is of special industrial interest. Here guinea-pigs have been exposed to different concentrations of different dusts, and have then been given either intraperitoneal inoculations with tubercle bacilli, or intratracheal inoculations with pathogenic cocci, particularly pneumococci. Rats (animals which are more resistant to tuberculosis infection than guinea-pigs) have been studied on similar lines, with a view to learning whether exposure to phthisis-producing dust by inhalation affects either their resistance to tuberculous infections or the character of the lesions when infection occurs. Rats, too, have been kept in cages underground under varying conditions, so as to compare their duration of life with control animals. The general conclusions are as follows:

Guinea-pigs that have inhaled phthisis-

producing dust, after either intraperitoneal inoculation with tubercle bacilli or intratracheal inoculation with pathogenic cocci, may develop a condition of the lungs comparable to that met with in sufferers from miners' phthisis.

Normal guinea-pigs that receive intratracheal inoculation with pathogenic cocci either die within forty-eight hours or recover completely. Guinea-pigs that receive similar inoculation after exposure to phthisis-producing dust either die within forty-eight hours, or, in the majority of cases, develop a fatal chronic unresolving pneumonia.

Rats that receive intraperitoneal inoculations with tubercle bacilli after inhaling phthisis-producing dust have their resistance to tuberculous infection lowered, and the most marked lesions are found in the dust-laden lungs, while the abdominal organs are but little affected.

Rats kept in cages underground do not live more than eighteen months, and, in many cases, die of pulmonary tuberculosis. Tubercle bacilli are to be found both in sections of the lungs and in smears, and the finding has been confirmed by culture and subinoculation.

In connection with the studies it has been remarked that, in a certain proportion of the fatal cases of acute tuberculosis in natives, both the course of the disease and the nature and distribution of the lesions found post-mortem have suggested the so-called "pseudo-tuberculosis" of certain animals rather than tuberculosis as met with in white races. Given exposure to phthisis-producing dust, the possibility of a mixed infection seemed worth consideration. Attempts have been made, so far unsuccessfully, to isolate from such cases any of the various organisms associated with the pseudo-tuberculosis of animals.

Allowing for age of incidence, it is thought that the majority of cases of silico-tuberculosis would not have developed the tuberculosis without an antecedent invasion by a certain amount of phthisis-producing dust. The amount of phthisis-producing dust that must be inhaled to produce damage *per se* (*i.e.*, simple silicosis) is very much greater than the amount necessary to lower immunity to tuberculosis in susceptible subjects. While phthisis-producing dust has been controlled to such an extent that it probably no longer produces disablement *per se*, we must aim at a further reduction to reduce it below the level at which it affects resistance to tuberculous invasion of the lungs. There are grounds for hoping that such a further reduction is practicable.

Steps are being taken to test the Kotzé konimeter and also, by use of an experimental tunnel, to investigate methods of ventilation, cooling, dust control, and dust estimation.—E. L. C.

COAL DUST EXPLOSIONS: HOW THEY CAN BE PREVENTED: SIMPLE REMEDY IN PRACTICAL OPERATION. *J. E. Jones. Am. Labor Legis. Rev., March, 1924, vol. 14, pp. 35-50.*

This article is well summarized in the words of the writer:

"As we have seen, the three principal factors required to produce a coal dust explosion are an open light, an accumulation of gas and explosive coal dust. The first factor is removable by the installation of enclosed lights found permissible by the Bureau of Mines. The second can be minimized by proper ventilation and inspection but this hazard will always exist in a gaseous mine. The third *can be eliminated* by neutralizing the coal dust with incombustible dust, making a mixture that is non-explosive.

"Explosions are charged with the greatest number of fatalities in Franklin county, therefore our greatest effort is exerted to reduce this hazard. Explosion accidents have been reduced greatly during the last quarter of the eighteen-year period. Of the 12,855 men working underground, 1,925 are protected with enclosed lights and 4,350 are protected with shale dust."—H.B.E.

STARCH DUST EXPLOSIONS. *G. E. Chamberlain. Abstr. as follows from Chem. Age, 1924, vol. 32, pp. 95-97, in Chem. Abstr., July 20, 1924, vol. 18, p. 2251.*

The article notes certain disastrous explosions in starch works, classifies carbonaceous dusts, gives detailed consideration to the reduction of the hazard, discusses conveyors, storage of starch, importance of humidity, static electricity, isolation of buildings and precautions. Humidifying is regarded as the chief protection against dust explosions. Large window area diminishes the extent of damage. It is estimated that there are 21,000 plants in the United States, marketing goods of $7,000,000,000 value yearly, liable to dust explosions.—P.D.

OCCUPATIONAL INFECTIOUS DISEASES: OCCURRENCE, TREATMENT AND PREVENTION

Chronic Arthritis in Relation to Industrial Accident Cases. *L. W. Ely. Abstr. as follows from Cal. and Western Med., June, 1924, vol. 22, p. 260, in Jour. Am. Med. Assn., July 26, 1924, vol. 83, p. 303.*

Ely says that bone can be injured in one way only, and that is by fracture. It cannot be strained, sprained, or suffer contusion. Trauma either fractures a bone or leaves it uninjured. In the absence of a fracture, bone can be attacked only by a disease of its contained marrow. There is one important aspect of the great second type of arthritis in its relation to industrial accident work, as well as to other surgical work, that has not received the attention it deserves, namely, its relation to intra-articular fractures. To it are probably due the stiffness, pain, and restriction of motion following intra-articular fractures in elderly persons, and the only rational explanation for this fact is that the fracture set free into the joint the infectious material previously locked up with the bone. —K.R.D.

Tuberculosis in Miners. *Paris Letter, Jour. Am. Med. Assn., May 31, 1924, vol. 82, pp. 1794-1795.*

This is a review of a paper on tuberculosis in miners presented by Dr. L. Croizier, physician to the hospital of Saint-Etienne, which is the center of a rich coal region. For the years 1920, 1921, and 1922, the deaths among the entire population covered by Croizier's statistics, miners excepted, amounted to 10.5, 11.5, and 14 per cent., respectively, whereas among miners the percentages of deaths from tuberculosis for these years were 20.3, 31, and 34—or almost twice as large as among the remainder of the population.

Croizier believes that coal dust is not a negligible factor in the severity and high incidence of tuberculosis among miners. It is always at the site of the tuberculous lesions that anthracosis exists or is most marked. It is rather exceptional to find any considerable collections of coal dust in the parts of the lung not involved by tuberculosis; on the other hand, it is frequent to find these collections in the diseased portions of the lungs, where they may or may not be the site of an advanced ulcerative process. Patients who do not have these collections of coal dust have the ordinary caseous tuberculosis; those who have such collections are more likely to develop fibroid tuberculosis, the coal dust furnishing, it seems, the elements that promote such organization.

Another factor contributing to the spread of tuberculosis among miners is the presence of numerous infected persons in a confined, imperfectly ventilated area.—K.R.D.

High Tuberculosis Rate among Boot and Shoe Operatives. *London Letter, Jour. Am. Med. Assn., July 5, 1924, vol. 83, p. 51.*

At the conference of the National Union of Boot and Shoe Operatives, a resolution was carried calling for legislation to secure a reasonable standard of light, air, and cleanliness in all workshops and factories used for the manufacture of boots and shoes. Mr. W. R. Smith, parliamentary secretary to the ministry of agriculture, said that the percentage of their members who died of tuberculosis up to 45 years of age was staggering. In 1910 it was 52 per cent.; in 1913 it fell to 50 per cent.; in 1914 it rose to 54 per cent.; in 1921 it was 44 per cent.; but in 1923 it again went up to over 50 per cent. They were still without a proved cure for this terrible disease. That ought to indicate the desirability of concentrating on securing such changes and reforms within the industry as would reduce these figures.—K.R.D.

Pneumoconiosis and Tuberculosis. *F. Ickert. Abstr. as follows from Deutsch. med. Wchnschr., Leipzig, June 20, 1924, vol. 50, p. 832, in Jour. Am. Med. Assn., Aug. 2, 1924, vol. 83, p. 393.*

Ickert observed about 400 cases of pneumonokoniosis with tuberculosis among the men working in the copper-slate mines of Mansfeld. The dust inhaled consists of lime, silicates, aluminium oxide, and bitumen. It seems to mitigate the course of tuberculosis. Only one of them, who had been working for two and one-half years, had a caseous pneumonia. Cirrhoid types were present in the

others. The men suffer from dyspnea, due probably to cirrhosis of the lungs, and die between the ages of 50 and 60. This is later than in other tuberculous persons. Many of them have bacilli in the sputum and spread the disease because they feel comparatively well. He counted 35.5 per cent. of infections and deaths from tuberculosis in their families.—K.R.D.

THE TREATMENT OF ANTHRAX BY INTRAVENOUS INJECTION OF NEOSALVARSAN. *O. Grasser. Abstr. as follows from Wien. klin. Wchnschr., 1924, vol. 37, pp. 261-263, in Med. Science, July, 1924, vol. 10, p. 296.*

Between 1918 and 1924 Grasser treated fifty-four cases of anthrax by intravenous injections of neosalvarsan with only four deaths, two of which were due to septicemia and one to pneumonia, while one was moribund on admission. In mild cases a single injection of 0.45 to 0.6 gm. was sufficient. In severe cases, of which striking photographs are reproduced, the injection was repeated two or three times. Many mild cases were treated in the outpatient department. Shortly after the injection the temperature rises to 101.6° or 104° F., and there is more or less violent shivering. A similarly rapid fall of temperature occurs accompanied by profuse sweating. In some cases, however, the fall of temperature is not so sudden, and three or four days may elapse before it becomes normal.

OCCUPATIONAL AFFECTIONS OF THE SKIN AND SPECIAL SENSES

HEXAMETHYLENAMIN POISONING IN THE RUBBER INDUSTRY. *H. J. Cronin. Jour. Am. Med. Assn., July 26, 1924, vol. 83, pp. 250-251.*

Cronin reports the poisoning of sixty employees in a rubber factory by hexamethylenetetramine used as a catalyzer in the vulcanization of the rubber. Only an ounce or two of the substance was used in an average bath of 100 pounds or more of rubber stock.

The first symptoms were redness of the face and exposed parts of the arm, followed by fine, watery, itchy vesicles, and later edema. The forehead, cheeks, and sides of the neck were the affected parts of the head; while the backs of the hands, between the fingers, and the entire forearm were the other parts involved. Extreme itching was the principal symptom complained of by the men. Many of the patients later had indolent, deep infections that resisted treatment. Removal of hexamethylenetetramine from all rubber stock alone prevented further cases. —K.R.D.

OCCURRENCE AND PREVENTION OF INDUSTRIAL ACCIDENTS

ESSENTIALS OF FIRST AID WORK. *H. W. Gentles. Nat. Safety News, Aug., 1924, vol. 10, pp. 5-7.*

First aid is not a substitute for accident prevention; it is, rather, a valuable addition to accident prevention activities. The employee trained in first aid is invariably a safe worker and a good influence in the plant. The purpose of first aid is to fill in the gap between the accident and the arrival of the physician when seconds are valuable. Simplicity is the first essential in first-aid instruction. A minimum standard of instruction should be maintained; the standards set by the Red Cross are recommended.

In giving instruction, non-technical methods should be used and practice without a kit should be generally favored because workers are apt to become dependent on them. Of course, some training with a kit should be insisted upon. Interplant first-aid contests are suggested for the purpose of stimulating interest in this work.

Allusion is made to the criticism frequently heard that young physicians are not acquainted with certain very important first-aid measures such as the Schäfer or prone pressure method of resuscitation.—H.B.E.

NEEDLESS COAL MINE ACCIDENTS: A PROGRAM FOR THEIR PREVENTION. *J. B. Andrews. Am. Labor Legis. Rev., March, 1924, vol. 14, pp. 22-34.*

Showing that there is a needless number of coal mine accidents in the United States by comparing statistics of this country with those of Great Britain—the fatality rate per 1,000 workers was a little more than three times as great in the United States as in the United Kingdom for each of the years 1919, 1920, and 1921—Mr. Andrews discusses favorably the following proposals for reform submitted recently to the United States Coal Commission by a committee of experts:

1. The adoption of uniform legal minimum standards of safety.

2. The use underground of no explosive that is not after scientific investigation numbered among the "permissibles;" the strict limitation of "shooting off the solid;" and the use of shale or approved rock dust to check the spread of coal dust explosions.

3. Reward careful employers and penalize the less scrupulous, by the universal adoption of schedule rating for insurance under accident compensation laws, with a further graduated penalty for cases of wilful failure to put into effect legal safety regulations.

4. An adequate mine inspection staff selected on a merit basis of training and experience, fairly paid for reasonably long tenure of office, and protected from partisan interference whether political or industrial.

5. Greater public authority, federal and state, to procure and disseminate information, and to establish and maintain on a uniform basis reasonable minimum standards of safety.—H.B.E.

SUGGESTIONS FOR COAL MINE SAFETY IN THE ANTHRACITE FIELD. *T. Kennedy. Am. Labor Legis. Rev., March, 1924, vol. 14, pp. 63-67.*

The more important suggestions are as follows: "If the companies paid the miners for all props, timber and other work necessary to make their working place reasonably free from danger, they would pay less in compensation for the injured, or for death to dependent widows and orphans."

"In my opinion important factors that would tend to decrease the fatal and non-fatal accidents due to falls in the faces of the working places include the proper ventilation of the faces; the placing of timber, props and other necessary supplies, with extra compensation to the miner for such safety work; the taking into consideration of the judgment of the miner, and the strict enforcement of the Miner's Certificate Law so that none but competent men shall work at the face."

"If the coal operators in the anthracite region lived up to the mine law with respect to ventilation it would be impossible for a gas explosion to occur."—H.B.E.

FLAME SAFETY LAMPS. *J. W. Paul, L. C. Ilsley, and E. J. Gleim. Abstr. as follows from U. S. Bur. Mines, Bull. No. 227, 1924, pp. 212, in Chem Abstr., Sept. 20, 1924, vol. 18, p. 2964.*

Deals with the history, evolution, résumé of European investigations and regulations, United States national and state regulations, operation and maintenance of lamps, lamp-testing stations and their equipment, investigation of safety lamps in still and in moving explosive atmospheres, igniters for safety lamps, illuminating powers of flame safety lamps, investigation of gauze fabrics, investigation of the behavior of flame safety lamps in gaseous and coal dust laden atmospheres, flame safety lamps approved by the Bureau of Mines and the detection and measurement of methane.—P.D.

AN ANALYSIS OF FIFTY CIRCULAR SAW ACCIDENTS INVOLVING THE LOSS OR INJURY OF SEVENTY-SIX FINGERS. *N. Y. State Dept. Labor, Div. Indust. Hyg., 1924, pp. 5.*

The Division of Industrial Hygiene of the New York State Department of Labor has been studying accidents from circular saws with a view to comparing the value of the several varieties of saw guards in saving the fingers of the operators. An analysis of statistics collected during a period of three months indicates that in a series of accidents to fifty workers thirty-eight saws, or 76 per cent., were not equipped with guards. Safe methods are advised and illustrated, as it is believed that unsafe methods of work were the chief cause of the accidents mentioned. The relative value of different varieties of guards is not discussed.—H.B.E.

INDUSTRIAL MEDICAL SERVICE: MEDICAL DISPENSARIES AND HOSPITALS IN INDUSTRIAL PLANTS

SOME RANDOM THOUGHTS ON THE PART OF A PLANT PHYSICIAN. *W. S. Ash. Nation's Health, July, 1924, vol. 6, pp. 460-461, 503-504.*

The aims and ideals of the plant physician may be formulated thus:

1. To provide physical examination to fit the man to the job.

2. By noting the nature and frequency of an injury, to co-operate with the management in protecting the worker by preventive measures, including mechanical safeguards.

3. To provide care for the relief of those who suffer injury or sickness notwithstanding all reasonable effort at prevention.

It is an excellent plan to have the employment office and the factory doctor occupy adjoining quarters, thus simplifying the initial examination.—E.S.C.

FIVE HUNDRED HEALTH EXAMINATIONS OF INDUSTRIAL WORKERS. *Philadelphia Health Council and Tuberculosis Committee—Memorandum, Aug., 1924, vol. 2, pp. 12.*

In the year 1923 the Philadelphia Health Council and Tuberculosis Committee inaugurated an industrial health service having a threefold service: (1) to promote the idea of health service in industrial plants as a part of their administration; (2) to supply a limited medical service in smaller plants for a temporary period for its immediate value to the employee; (3) to stimulate interest and to disseminate health information among both employers and employees.

Ten plants were visited and a total of 507 health examinations were made up to February 1, 1924. A statistical analysis of these studies shows that 90 per cent. of the persons examined were native born and that the group was composed of 63 per cent. (321) factory workers, 29 per cent. (145) office workers, and 8 per cent. (39) field workers. Of the group, 64 per cent. (327) were men and 36 per cent. (180) women. Nine per cent. of the women were under 18 years of age as against 3 per cent. of the men. Only 5 per cent. of the women were over 34 in comparison with 29 per cent. of the men.

The group was composed of permanent workers for the most part. Only 12 per cent. were newly employed; 32 per cent. had been employed from one to three years, 18 per cent. from four to seven years, and 25 per cent. eight years or more.

The total amount of time lost from work on account of sickness was 1,157 days. Twelve per cent. had lost one week or more on account of sickness; 10 per cent. had lost less than one week.

Twenty-seven per cent. (135) had not visited a physician during three years prior to the examination; 28 per cent. (143) had visited a physician within two or three years, and 37 per cent. (190) within one year. Seven per cent. (34) said they had never consulted one.

Among other important conclusions which were determined are the following:

1. That the factory workers made the poorest physical showing.

2. That workers employed from one to three years made the best physical showing.

3. That physical conditions found do not seem to have been appreciably influenced by the number of hours of work per week.

4. That no correlation was found between poor physical condition and the amount of time lost.

5. Lung defects were found in thirty cases, or 6 per cent. Of these sixteen, or 3 per cent. of the total group, were diagnosed as tuberculosis, giving a rate of three cases of pulmonary tuberculosis for each 100 cases examined, a rate somewhat higher than the general tuberculosis rate of the population.

Persistent follow-up work was the policy for cases where defects were found, and an extension of this program is advised. It is claimed that the workers' interest in this health service was aroused and that the results suggest that periodic health examinations should be required. Also, it is advised that public health agencies should make it possible for small plants to have the benefit of industrial health service.—H.B.E.

A GOOD INDUSTRIAL HEALTH ORGANIZATION. *Nation's Health, Sept., 1924, vol. 6, pp. 623-625.*

The Scovill Manufacturing Company at Waterbury, Connecticut, began its industrial health service ten years ago. Careful records of all accidents and "near accidents" are

kept, which are made the subject of intensive study to determine adequate measures of prevention. The article is illustrated with a floor plan of a plant hospital, as well as photographs and a graph showing the percentage distribution of accidents by the hour of day.—E.S.C.

THE UNITED FRUIT COMPANY. *Jour. Am. Med. Assn., July 5, 1924, vol. 83, p. 61.*

This Company maintains hospitals and dispensaries in Central and South America and the West Indies, and dispensary service in the ports of Boston, New York, and New Orleans. Its medical department takes care of employees and their dependents in the tropics, and of the inhabitants of communities adjacent to plantations when other medical service is not available. It supervises all matters concerning quarantine and immigration affecting the Company's interests and the sanitation of the Company's steamships. In the 1923 annual report of the medical department it appears that 28,398 cases were treated in the Company's hospitals, 227,545 treatments were given in its dispensaries, and 10,170 cases were treated on its steamships.

The Company planted during the year 40,878 acres of virgin land, which had to be cleared of the jungle, then drained, and camps built. This work in particular was responsible for the high hospital admission rate of 421 per thousand employees.

The death rate, 13.01 per thousand, was little more than the general death rate for the United States. Malaria was responsible for the greatest morbidity, causing 38 per cent. of the hospital admissions, and about 13 per cent. of the deaths. Pneumonia was responsible for 22 per cent. of the deaths, dysentery for more than 7 per cent., nephritis for more than 5 per cent., and external causes for about 7 per cent. Venereal infections comprised almost 6 per cent. of the hospital admissions and 5 per cent. of the dispensary treatments; injuries comprised 9 per cent. of the hospital cases and 11 per cent. of the dispensary treatments. On the average, patients with malaria received a total of 15 gm. of quinine by mouth, and patients unable to take quinine in that manner averaged two hypodermic injections of 1.4 gm. each. The treatment of erysipelas was attended with excellent results, the well-known method of swabbing with phenol (carbolic acid) and then neutralizing with alcohol as soon as a white coating appears being employed. The temperature usually dropped to normal within from three to six hours. The same treatment was used for herpes zoster, with equally excellent results.—K.R.D.

INDUSTRIAL PERSONAL AND COMMUNITY HYGIENE: HOUSING, ETC.

FLAT FEET AND THEIR TREATMENT. *C. F. N. Schram. Nat. Safety News, Aug., 1924, vol. 10, p. 10.*

There are many degrees of fallen or broken arches. In nearly all early cases the correct treatment is proper shoes. Summing up, Dr. Schram gives the following suggestions for treatment.

1. Provide the patient with proper shoes, and, as a rule, raise the inner border of the heel and sole a quarter of an inch, enough to throw the weight on the outer border of the foot.

2. Call the patient's attention to the improper attitudes he has been assuming, showing him that he must at all times try to throw his weight on the outer border of his feet, that he must walk with his feet parallel, try to press down the soles of his shoes with his toes and employ the lift of the calf muscle by fully extending his leg and raising his body on his foot.

3. Give the patient exercises to strengthen the proper muscles.—H.B.E.

SOME SUGGESTIONS FOR INDUSTRIAL HOUSING. *Nation's Health, June, 1924, vol. 6, pp. 419-420.*

In contradistinction to the old "company" houses, present housing schemes involve some system of financing by which the occupant becomes owner of the property. There are construction companies that give special attention to the complete building of industrial communities. Sometimes there are safeguards as to open spaces and sanitation. Front elevation and floor plans of one and two-story dwellings for employees illustrate the article.—E.S.C.

INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL MANAGEMENT IN ITS HEALTH RELATIONS

OCCUPATIONAL PSYCHOLOGY AND FATIGUE. *W. Nuttall. Abstr. as follows from Internat. Ztschr. f. Individual Psychol., Jan., 1924, p. 12, in Brit. Med. Jour., July 5, 1924, Epitome Current Med. Lit., p. 3.*

W. Nuttall considers that experimental research is of practical value in the study of occupational psychology, and more especially with regard to the choice of an occupation. Much has been accomplished in this way, but experimental tests and classification of reactions do not solve the problem completely. Even though these tests indicate an aptitude for a certain calling, it does not follow that the individual will do that work properly, nor that he will be happy in that occupation, nor that he will be able to obtain the particular work for which he appears to be suited. There is much latent talent in children which may be developed by encouragement, or checked by the failure of parents or teachers to discover its existence. Attention should be directed not only to choice of occupation but also to the individual's attitude toward work in general. There are many disillusioned individuals in the world today who make no attempt to follow their calling, and who furthermore discourage others. Nuttall concludes that it is highly important to encourage a courageous and adaptable outlook toward work; and that the problem of industrial fatigue is wider and deeper than consideration of physical environment in mills and workshops—it is a problem of conflict between the world outlook of the individual and that of the society into which he happens to be born.

AN INDUSTRIAL PERSONNEL RESEARCH PROGRAM. *J. H. Willits. Jour. Personnel Res., Aug.-Sept., 1924, vol. 3, pp. 125-128.*

"The following formulation for a community industrial personnel research program is in part an outgrowth of Professor Willits' experience of the past four years in organizing and directing the research in which thirty Philadelphia concerns have coöperated with the Industrial Research Department in the Wharton School, University of Pennsylvania. This paper was presented at the meeting of the Personnel Research Federation on May 10."

Professor Willits broadly interprets the field of personnel research as including most of the research in the fields of psychology, anthropology, biology, physiology, and medicine, and much of such fields as economics, government, sociology, and history. He says: "The recently coined name 'personnel research' is no new form of research, but rather the recognition of possible new applications and combinations of old researches in different fields in such a way that new light will be thrown on old problems and new problems revealed on which original investigation is again much needed."

In order to prevent duplication of researches and to conserve and integrate all efforts in such research, Professor Willits proposes that industrial communities organize community industrial personnel research programs. These programs should be co-operative, stressing the study of the man in the job rather than the man out of the job; the studies should be of the "continuing" variety rather than of the "survey" type; and one study completed should suggest another. In concluding, Professor Willits suggests numerous subjects for community research.—H. B. E.

INDUSTRIAL SERVICE AND MUTUAL BENEFIT ASSOCIATIONS

EMPLOYEES' SUMMER VACATION RESORTS AS HEALTH PROMOTERS. *R. W. Liddle. Nation's Health, Sept., 1924, vol. 6, pp. 585-587, 640.*

In June, 1923, three Chicago utility companies purchased for the use of their employees a vacation summer resort, which now draws from a field of about 20,000 workers. The venture is considered most successful in promoting the health and happiness of employees. Rates are a little over one-half the cost of similar accommodations elsewhere.

Good food and many types of recreation are afforded.—E. S. C.

Hills Brothers Company Health and Welfare Activities. *Nation's Health, Aug., 1924, vol. 6, pp. 553-554.*

The work of the Hills Brothers Company of Brooklyn, New York, shows that welfare work can be successfully carried on in a firm numbering less than 1,000 employees, without elaborate or expensive equipment. This company maintains a dispensary and rest room where a nurse and assistant are on duty during working hours. It also carries group life and accident insurance on all its employees.—E. S. C.

Westinghouse Company Employees' Welfare Work. *J. E. Murley. Nation's Health, June, 1924, vol. 6, pp. 379-380.*

The Westinghouse Electric and Manufacturing Company finds that welfare work, in fostering the harmonious relationship between an organization and its employees, reduces the labor turnover and consequently is a good investment. Among its measures are the adoption of the Saturday half-holiday, payment of benefits to employees in the event of disability incurred whether on or off duty, insurance, savings funds which permit the employee to borrow on his savings, night schools, scholarships granted to certain of the sons of employees, assistance for athletic clubs, a restaurant where food is served at cost, a company store, company magazines, and a hospital which cares for employees and their families.—E. S. C.

INDUSTRIAL HEALTH LEGISLATION: COURT DECISIONS: WORKMEN'S COMPENSATION AND INSURANCE

Changes in Workmen's Compensation Laws during 1924. *Am. Labor Legis. Rev., June, 1924, vol. 14, p. 170.*

The following important items are noted:

Reduction in the New York law of the non-compensated "waiting period" from fourteen to seven days.

In Massachusetts compensation is now paid from day of injury in cases lasting over twenty-eight days.

In New Jersey double compensation is provided for minors injured while illegally employed, a brief list of specified occupational diseases is included under the act, the penalty for non-insured employers is increased, and the act is extended to cover additional public employees.

In Maryland employees earning over $2,000 a year are now included, also salesmen and sales managers, members of the organized militia, and all state employees formerly excluded.

In Kentucky disability due to inhalation of gas, smoke, or "bad air" in mines is now compensable.

In Virginia, among other provisions, specific compensation for loss of hearing and for disfigurement cases is allotted, and protection of illegally employed minors is increased.

Extending Compensation for Silicosis. *London Letter, Jour. Am. Med. Assn., Aug. 23, 1924, vol. 83, p. 624.*

With the object of amending the law with regard to workmen's compensation to give effect to the recommendations of the first report of the Departmental Committee on Compensation for Silicosis, a bill has been introduced in the House of Lords. A memorandum issued with the text of the bill states that the Committee found that the presence of silicosis in any degree renders the workman specially liable to tuberculous infection, and that in the great majority of mixed cases the silicosis precedes the tuberculosis and predisposes to it. The Committee recommends that, subject to power being given to the medical officers to suspend from employment a workman found to be suffering from tuberculosis (without silicosis) or found at the first examination not to reach a prescribed standard of physique, patients with the combined disease should be compensated and otherwise dealt with in the same way as those with pure silicosis. —K. R. D.

SUBJECT INDEX TO VOLUME VI

This is a subject index to all the reading matter in the ABSTRACT OF THE LITERATURE OF INDUSTRIAL HYGIENE, and one should, therefore, look for the subject word. The name of the author follows the subject entry in parentheses.

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2. Health Poster Service—comprising authoritative general and seasonal posters on health and sanitation.

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